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Engineering News-Record

Equipment Engineering

YEAR AFTER YEAR the construction equipment manufacturer is able to look back upon a record of achievement. His efforts have long since made equipment engineering a controlling factor in the development of modern construction practices. Booming business encouraged and demanded mechanization. Manufacturers naturally met the demand. Fortunately they more than met it. During the past year, despite generally poor business conditions, no tendency for progress to lag has been discernible. The organization and methods of the industry that make this continued growth possible should be matters of common knowledge to every reader of this journal. This issue on equipment engineering is planned to epitomize them. And, for purposes of illustration, attention also is directed to a single field—tunneling—in which improved equipment is exerting an important influence. The authors of the articles are all recognized authorities in the equipment industry. The collective story they tell leaves no doubt that future construction advance is predestined to follow a mechanized path.

An Account of the Year's Progress

AND NINE OTHER ARTICLES:

Organization of the Equipment Industry, by Lion Gardiner
Origin of New Designs and Improvements, by Kenneth M. Talbot
Equipment's Place in Tunneling Progress, by John S. MacDonald
Tunnel Ventilation During Construction, by R. H. Rogers
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A Consolidation of Engineering News, Engineering Record, The Sanitary Engineer, and the Contractor

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VOLUME 106, NUMBER 15

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McGRAW-HILL PUBLISHING COMPANY, INC., Tenth Ave. at 36th St., NEW YORK, N. Y.

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CABLE ADDRESS: "MACHINIST, N. Y."

Published weekly. $5 per year. 25 cents per copy. Entered as second-class matter April 11, 1917, at the Post Office at New York, N. Y., under the Act of March 3, 1879. Printed in U. S. A.

Member A.B.C.
Member A.B.P.

NUMBER OF COPIES PRINTED THIS ISSUE, 31,869

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WASHINGTON, National Press Building
CHICAGO, 520 N. Michigan Ave.
PHILADELPHIA, 1600 Arch Street
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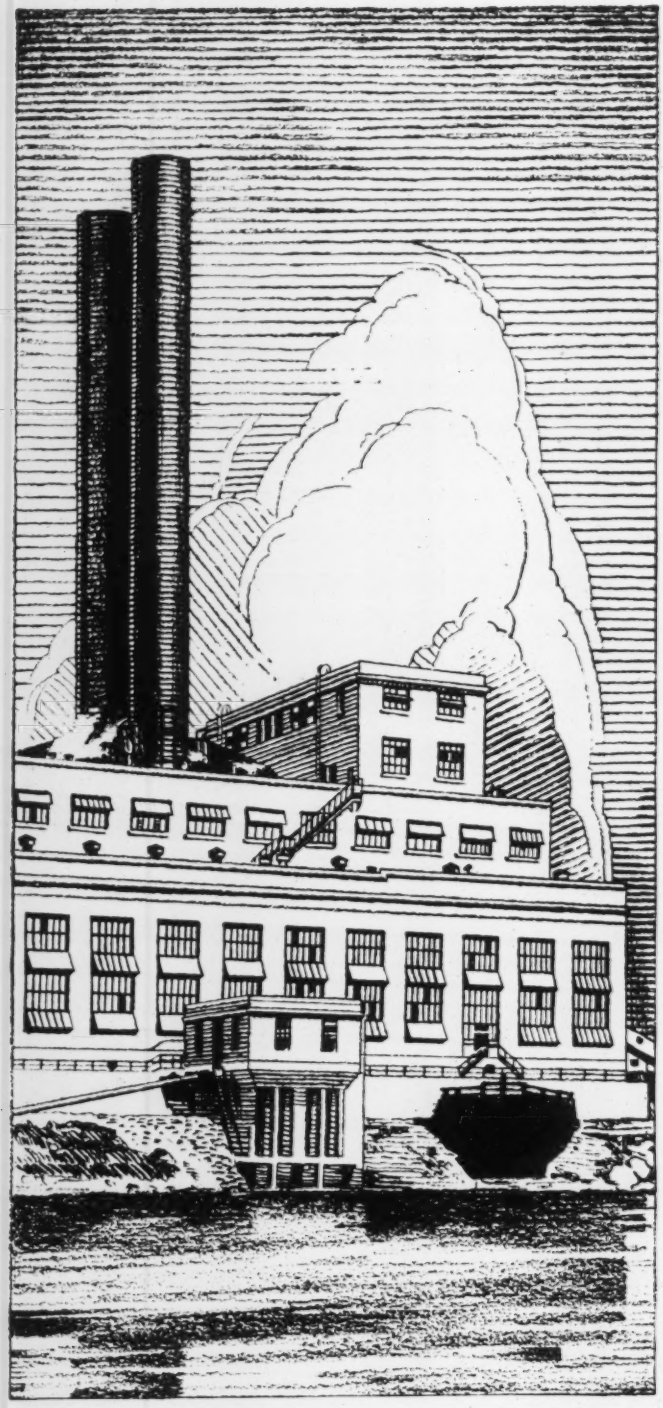

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ENGINEERING NEWS-RECORD

A McGRAW-HILL PUBLICATION — ESTABLISHED 1874

DEVOTED TO CIVIL ENGINEERING AND CONTRACTING

F. E. SCHMITT, *Editor*

Volume 106 NEW YORK, APRIL 9, 1931 Number 15

Construction Equipment Progress

YEAR after year the construction equipment manufacturer is able to look back upon a record of notable achievement. The advance represents more than mere mechanical production of machines—it constitutes a controlling factor in the development of modern construction practices. To analyze the trend of improvements in construction equipment, to summarize the advances made in the past year, and to evaluate the important part the equipment industry is playing in the progress of construction, is the purpose of this issue, devoted to construction machinery.

Mechanization of the construction industry was inevitable. Increasing volume of work made it a necessity, not only because of speed requirements but even more imperatively because of the vital claims of efficiency and economy of construction. Due credit must be given to the equipment manufacturer for meeting these demands. But he has gone farther than merely to fill the need for improved construction equipment—he has created the need. The manufacturer has injected engineering thought, aided by research, into design and production to such extent that today the construction industry cannot afford to neglect taking full advantage of his offerings.

During the past year, despite generally poor business conditions, no lag in equipment improvement has been discernible. This fact is portrayed by one of the following articles, a survey of improvements initiated or developed in the past season. The organization and methods of the industry that make continued growth in equipment possible should be matters of common knowledge to every reader of this journal. Two articles in this issue epitomize them.

ALTHOUGH progress in design of construction equipment has been a steady development, at no time has it been as fast as since the beginning of the present business depression. Far-sighted manufacturers, having gone through previous slack times, realized that they must keep ahead of competition to survive the present depression. Accordingly they bent every effort toward improving their products and developing new ideas.

Betterments and improvements have come fast, though few radically new ideas have appeared. As a result equipment efficiency and dependability are greater than ever before. Coordination of plant for fast and economical construction has reached a higher degree. Manufacturers not only have met the present situation with equipment improvements but have prepared for the future. They have taken advantage of a slump in production to devote more time and study to new requirements. One firm has ten new-design pieces of equipment ready to place on the market when the opportunity develops—machines that were designed by an engineering staff kept busy during slack times.

THE SUCCESS and progress of the equipment industry are largely due to the engineering which manufacturers are applying to their work. More and more is engineering thought being applied to the design of construction machinery. Several outstanding developments are the result. Anti-friction ball and roller bearings replace other types at every advantageous point. Heat-treated steels and alloy steels have been introduced to eliminate excessive weight and gain needed strength. Forgings and stampings are replacing castings. Cut-steel gears and inclosed gearing units are now almost standard. Motorization has had a far-reaching effect. Consideration is being given the operator in providing power controls and easier handled mechanical aids, permitting him to center his attention on the work in hand rather than on the machine.

Every type of construction equipment has been affected in this march for progress. The result of these and countless other improvements is the production of efficient, durable and smooth-operating machines capable of dependable maximum performance. The collective story told in the following pages by authorities of the equipment industry leaves no doubt that future construction advance is predestined to follow a mechanized path.

AN IMPORTANT single field of the industry—tunneling—has been selected for this issue as an illustration of the influence exerted by improved equipment upon present-day construction practice. Few fields of construction have been as fully mechanized as has tunneling. It is a field that has been quick to respond to every advantage offered by improved and new equipment. As a result speed and efficiency in tunnel construction have reached hitherto unknown heights. Equipment's contribution to the art of tunneling has made possible extraordinarily long and difficult projects.

This contribution is all the more remarkable when the conditions involved in tunneling are considered. Working space is always limited, often cramped. The work is inherently hazardous, and every unit of the construction plant has a vital share in keeping it as safe as is humanly and mechanically possible. Because frequently the projects are far from distribution centers and sources of supplies, dependability and durability are requirements in tunnel equipment to an extent found in few other lines. The development of the machinery used in tunnel building therefore stands forth as a noteworthy example of what the equipment art contributes to the power and service of engineering construction.

War Is On

A CEMENT price war is on, as the news of the markets and cement lettings demonstrates. Within less than two months prices have dropped into the subcellar. The net price at mill has gone to around a dollar per barrel; a few large contracts have been taken even lower, and a 74c. bid is reported. These figures are at least 50c. below those prevailing at the beginning of the year, and are below production costs.

Just now the large cement contracts of state highway departments are being let. Nearly ten million barrels have already been bought at abnormally low prices, and there is prospect that the rest of the year's commitments will go at similar figures. The effect, briefly stated, will be that consumers will save at least fifty million dollars, and the cement manufacturers, or more accurately the stockholders in cement companies, will lose this same amount. As in most wars, the bills are paid by people who had no voice in starting the war.

The causes: Cement producing capacity is much above consumption, nearly double the consumption of the last few years. Capacity has grown steadily, demand has remained stationary for four years, and in fact has declined a little—from 180 million to 160 million barrels. Under the circumstances there is enough business to utilize only some 50 or 60 per cent of the capacity of each mill; but a few makers have been aggressive, selling below the market or going beyond their natural shipping range to take a larger share of the business. When the others tired of this process, they started to fight back. All this is the usual, age-old story of price wars. Perhaps it was aggravated in the present case by the action of some highway departments, which, scenting a business chance, rejected bid after bid until they got the desired break.

At first sight this seems a happy outcome for the consumer. But it looks more dubious when we reflect that an industry is very much a unit, consumers and producers having an inseparable common interest, and that its welfare requires a reasonable state of business health in each element. Unsound commercial conditions among the producers cannot continue long without bringing loss also to the consumer. And, in fact, the whole business structure of the country is concerned, for the inevitable weakening of the industry must tend to weaken all business solvency and confidence.

Absurdity is at a high point when someone, after working hard to produce something, sells it for less than it cost him. It reaches its peak when an entire class of producers follows the same course by entering into a price war, in which each labors to hurt his neighbor regardless of his own injury. Yet such wars are an old phenomenon, and no preventive or cure has yet been discovered. Price understandings and production cartelization are unlawful. But a thing that is never unlawful is business sanity and firm adherence to the principle of not selling below cost. Perhaps such sanity and such principle are what the present situation needs.

Law and government have concerned themselves with excessive prices, but not with low prices. However, selling below cost was recently established as bad business ethics, indeed as unfair competition. Practical application of this rule might hasten a return to sanity. It could easily be made part of the inquiry recently ordered by the Senate, which is directed at the entire price and cost structure of the cement industry.

First plank in the business platform that accompanied our issue of March 5 is the principle that living standards must be maintained. Interpreted in the true spirit it will be seen to include the living standards of industry as well as of the individual. Since each industry as well as each individual contributes to the sum total of exchange, its progressive spirit and soundness of method affect the country's progress. The management of industry has a correspondingly large responsibility.

It is gratifying that steadier business thinking gained ground in recent weeks. The fact indicates that many men have recovered their balance and are resolved to maintain living standards for their business and their employees, and to work ahead on a basis of principle and enterprise. But if one group of men goes counter to this trend, by carrying on destructive price warfare, it will merely play into the hands of the deflationists and endanger our business recovery.

NOTES OF THE WEEK

Road Tax Raids

RAIDS on state road funds are multiplying. In most states it is the towns and cities that are demanding contributions on the plea that the improved state roads are turning great volumes of traffic into and through their streets and wearing them out. Occasionally a state is found where the demand is candidly based on the fact that there is money in the road fund and none in other funds. At this moment it is Florida in which newspapers and civic bodies are demanding that most if not all of the gasoline tax money should be taken from the road fund and be "diverted to other state or county use." Florida counties already receive 2½c. of the 6c. gasoline tax, and schools receive 1⅓c., leaving only 2c. for state road construction and maintenance, but it wants to take still more of the road money for general expense. Florida has seen hard times since the collapse of the land boom, and now with a business depression superadded the situation seems more severe than the local communities can endure. It may be that in other states the unusually active local demand for a share of state road tax money is due to similar reasons: former extravagance and present lack of endurance under depressed financial conditions.

Questionable Delay

AFTER three months' preparation, an act to add 20,000 miles of selected township roads to the state highway system is now before the Pennsylvania legislature for consideration. Meanwhile the state has ignored more than $8,000,000 of federal money and has awarded only very few highway contracts—this during the peak period of unemployment. The delay, it is said, is partly due to the fact that time was required to designate the township roads to be chosen for the state system. As the listing of these roads requires more than 1,100 foolscap pages of the draft for the new act it can be agreed that time was necessary. One also may be permitted to speculate on how much log-rolling is involved. But regardless of reasoning, the fact remains that Governor Pinchot has made a great failure: he has failed to use the money contributed by the nation to relieve unemployment and has thus failed to do his part toward putting men to work. Pennsylvania has long been a great leader in state highway construction, but for 1931 it takes its place far in the rear. It can redeem itself partly by acting promptly on the

greater road system, and starting work on road construction. Its state highway department can be depended upon to work rapidly and competently as soon as it is left free to do so.

Increase the Planning Forces

CONSTRUCTION work in some other regions is not being got under way as rapidly as it might. In some quarters political and financial complications are responsible, but elsewhere slowness in developing plans and making ready for bids is at fault. Under present conditions it is of highest importance that the planning organizations be enlarged and brought up to maximum output. But no increase has been made in these departments of public work; reliance is universally placed on the regular staff to turn out greatly increased volumes of work—which is not possible. In the meantime, engineers of ability and experience are looking for work. Because they are not enlisted in the campaign to speed up work planning to the contract stage, engineers remain idle and work must wait, leaving contractors, craftsmen and manufacturers idle also. The immediate course for every works authority to advance public welfare lies in enlarging its engineering staff at once, in order that contracts may be pushed ahead to letting.

Earthquake Losses

SOMEONE has computed that the annual loss of life caused by earthquakes all over the world is only half as great as the toll of automobile accidents in the United States alone. Hence, presumably, earthquake hazards may be disregarded! The reasoning is not convincing. Disasters such as the destruction of Managua picture impressively the ruin of human works and hopes that a great earthquake brings—in this case even to the probable abandonment of the very site of the city. It is this overpowering effect that lays such emphasis on the importance of learning how to build strong enough to resist earthquakes. Even at Managua a few structures of engineering design appear to have survived unharmed, demonstrating the power of modern construction. More thorough application of structural principles in other buildings would enable future damage to be held to more tolerable limits. Our best present knowledge is far too scanty, however, and when study of earthquake resistance is carried farther we should be able to build with still greater certainty.

Canals and Earthquakes

WHAT effect will the Managua earthquake have upon the proposed Nicaragua Canal? That question is heard on all sides. Practically it will have no effect, for the simple reason that there is little likelihood of the Nicaragua Canal being built until years after the Managua quake has become just another quake in the long list of earthquakes in a region where periodic disturbances of that sort are taken as a matter of course. Regardless of what the army engineers now resurveying the route for a canal across Nicaragua may report to Congress as to the feasibility of such a project, the fact remains that it is still entirely without economic justification. Those who persuaded Congress to authorize a resurvey of the Nicaragua route visualized the Panama Canal as being taxed to its capacity within a few years. They based their conclusions upon a straight-line projection of the curve of Panama Canal traffic in the period since the war. But that curve reached a peak in 1928 and has been declining since. Further, oil shipments from the California fields made the slope of the traffic curve out of all proportion to the normal increase in general freight. The Panama Canal was carrying only 50 per cent of its present capacity of 60,000,000 tons in the peak year of 1928. Upon the completion of the Madden reservoir and a third set of locks the capacity will be raised to 143,000,000 tons, or more than four times the present traffic. Under such conditions and with economic justification entirely lacking, the spending of something like 700 million dollars on a second canal now would be the utmost folly.

Publicity on Airplane Crashes

FOR the first time in history the U. S. Department of Commerce has published the results of its investigation of an airplane crash. It should receive messages of sincere appreciation from everyone interested in the future of commercial aviation, and most of all from the airline operators themselves, whose short-sighted, archaic views on the suppression of news of official investigations of airplane crack-ups has been harmful in the extreme. Tragic as was the airliner crash in Kansas last week, it is reassuring to know that the probable cause of the accident was a broken propeller. Designers are thus afforded a definite objective toward which to work in improving airplane details, and the public is not left with the impression that airplane crashes result from something occult and inevitable. It is not usual for wings to drop off of airplanes because of a high wind or ice accumulation, for pilots to go to sleep, or for planes to explode in mid-air, but many persons still hold these beliefs because they are always among the *unofficial* reasons that appear following an airplane crash. Full publicity of airplane crack-up investigations is one of the most important steps the aeronautical industry has taken to invite confidence in flying.

Labor's Failure

IS THE man who builds forms for concrete a carpenter? Or, more precisely, can any able-bodied man other than a carpenter build forms for concrete? Carrying the question farther, should the men who set up wood or steel form panels and strip them be classed as carpenters? These are questions critically involved in the interpretation of subway contracts in New York. An accountant of the city controller's staff has just concluded from an investigation that form builders are carpenters and should be paid as such, under the "prevailing rate of wages" law. The same conclusion determines that setting and stripping forms does not require the skill of a carpenter, and that men engaged in such work are not entitled to carpenters' wages. These interpretations set back labor relations in the construction field by some years. It does not require an articled or apprenticed carpenter to build forms, nor do many of the operations in subway construction work require the special skill of recognized building trades crafts. That is as well known to labor as to the contractors! But labor has taken no steps to establish a special craft position for form builders. Its demand that they be classed as carpenters will force contractors to fuller use of steel forms or, if wood forms are preferred, of mill-built form work. So long as labor is to this extent remiss in working to the best interests of construction, it will not have its rightful place in the industry.

The Year's Progress in the Development of Construction Equipment

SEVERAL new ideas and designs in construction equipment were produced during the past year. More significant, however, is the emphasis shown in distinct trends toward improvements in design and materials. While most of these trends had their beginnings more than a year ago, they reached a high point of development last season and early this season. Modern construction machinery shows the influence of engineering thinking and the results of research.

The most marked trend affecting every line of construction equipment is the adoption of frictionless ball and roller bearings wherever possible. This does not mean that other types of bearings are being entirely supplanted; but frictionless types are being placed wherever conditions or operations permit their installation. The durability of these bearings, comparatively new to the construction industry, is cited by one manufacturer of general equipment. Nearly 30,000 installations of ball and roller bearings have been made by this manufacturer in equipping machinery produced in his plant during the past four years, and only 28 replacements in the field have been necessary in this period.

Wider Use of Alloy Steel

Another line of development in construction machinery is the adoption of lighter and stronger alloy metals. Drop forgings are being widely used instead of castings. Many parts are now heat-treated to provide additional strength. The use of steel alloys marks the abandonment of the old idea that a heavy machine is a strong machine. Sturdier construction of equipment is a rule today, but weight is being eliminated in acquiring sturdiness. Reducing the dead load means the replacing of slow clumsy machines by light high-speed units.

Evidenced by the improvements being made, the equipment manufacturers are striving to produce machines economical to operate and having a greater output, increased power and performing more efficiently with less maintenance. The modern construction machine is a multiple-purpose unit whenever possible and is easily convertible, resulting in reduced investment for capacity and variety of performance.

Along with the adoption of frictionless bearings and alloy steels comes the inclosing of gear trains. Gears formerly running in the open, subject to abrasion by dirt and grit, now operate in tight housings in a bath of oil. This change has resulted in marked decreases in maintenance costs. Clutches and brakes have come in for a share of improvement and are now being made larger and more dependable than formerly.

Motorization of construction equipment and increased use of power is a development that reached a new peak last year. Scrapers, road maintainers, graders and road-building machinery of all types, formerly pulled, have been made self-propelled units. To the motor truck, long used only for hauling, has been attached all sorts of blades, scrapers and scarifiers. The modern motor truck fully equipped is an all-purpose piece of equipment.

Motorization of construction machinery has not been restricted to prime-mover units. Power supplied by auxiliary units is now utilized for the operation of many pieces of equipment—as, for example, the drive on the modern elevating grader. The trend in power for equipment is toward the multiple-cylinder automotive-type gasoline engine for the smaller units and toward diesel engines for larger units. Electric motors also are finding a prominent place in the construction field.

All manufacturers are giving consideration to the operator of equipment. Power takeoffs, separate power controls and automatic operation are designed to relieve the operator from as much manual work as possible. This permits the operator to devote more time to the work the machine is doing and less to the machine itself. Inclosed cabs, better seats and arranging the controls to permit better vision of the work are examples of the results of the thought being given the operator.

Crawlers for both traction and load carrying seem to have reached the peak. Every conceivable type of construction equipment is now furnished with crawler treads if desired—tractors, wagons, graders, scrapers, trucks, cranes, shovels, excavators and many others. Last year saw the adoption of the rubber-track crawler, a variation from the steel tread. Faster speeds and travel over pavements are two possibilities in favor of this type of crawler.

Pneumatic tires made strong inroads into the field of the steel wheel last year. Dual arrangements seem to be favored, especially for traction drive. Many pieces of equipment, especially for road building and maintenance, are equipped with pneumatic tires on non-traction wheels and crawlers or heavy solid tires on traction wheels.

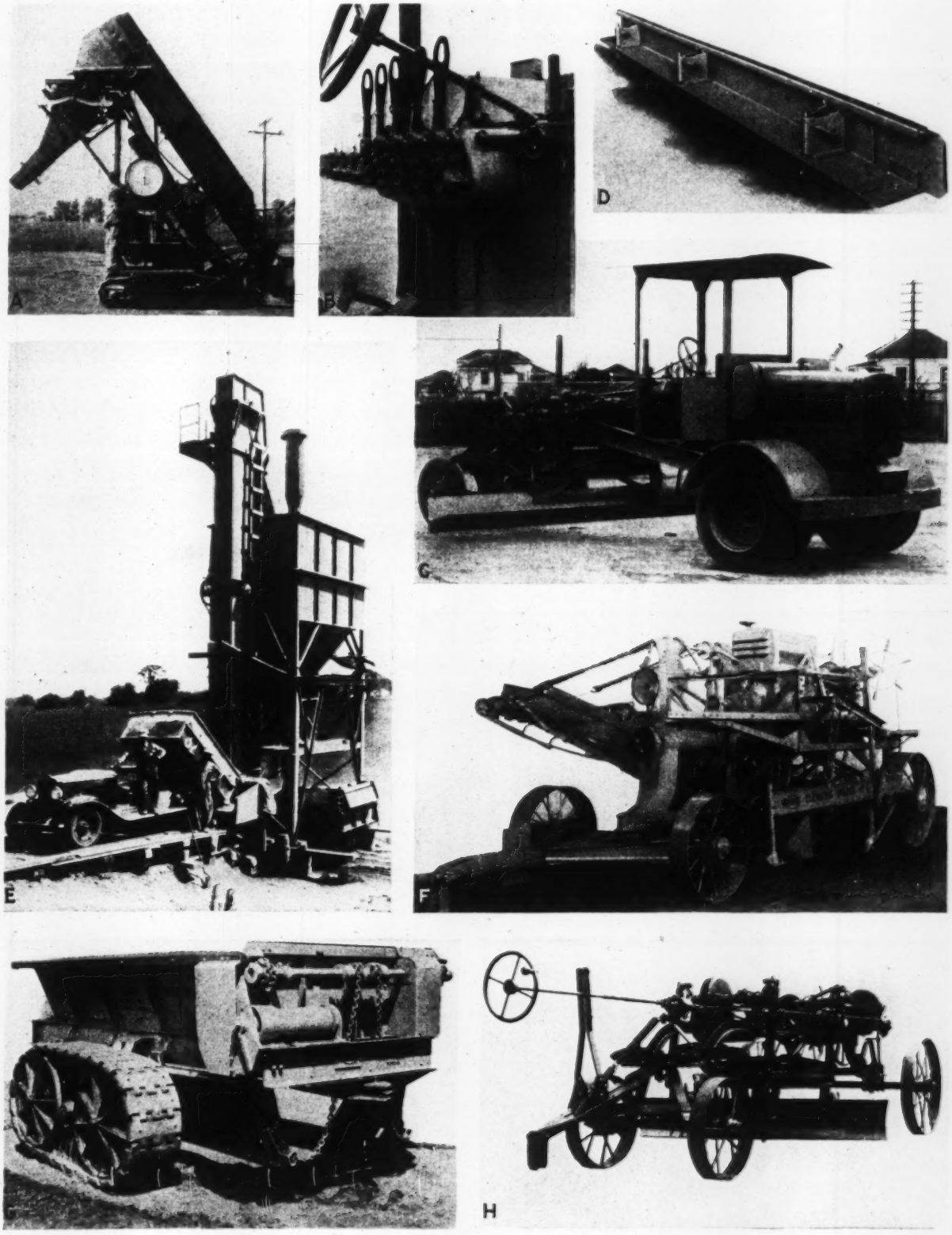
Trends and improvements, new designs and new ideas for specific representative machines in the construction field are given below. Obviously, it is impossible to cover the entire field; nor is it possible to mention all the improvements in any one line of equipment.

Road Building and Maintenance

A power subgrader, a revolving milling cutter with teeth set to the crown of subgrade, working in combination with a conveyor, now cuts an accurate grade and delivers the excavated material to the outside of the forms. With the increasing use of tandem mixers, requiring greater lengths of subgrade per hour, this tool is an important development.

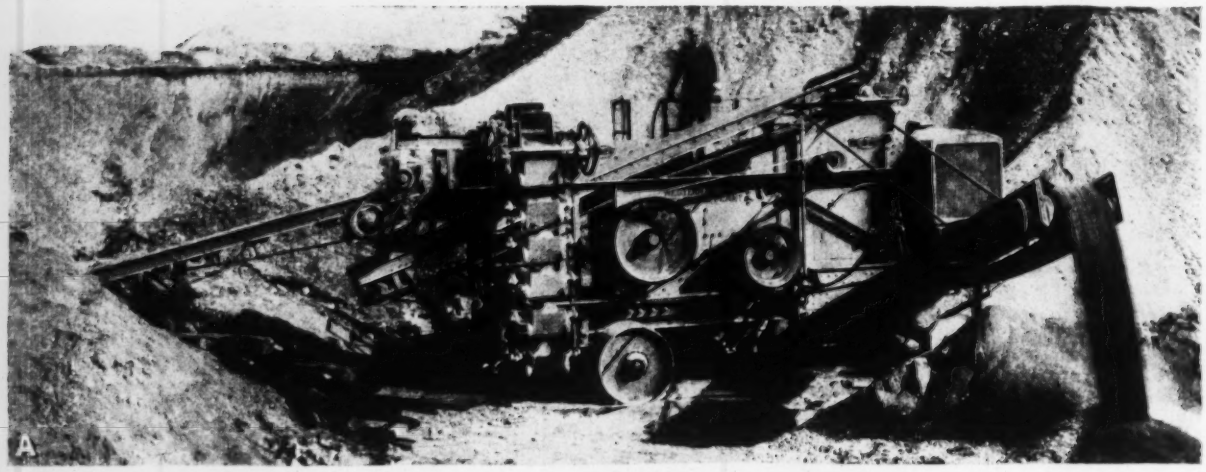
A digging conveyor machine is now on the market that will cover freshly laid concrete road slabs with a uniform thickness of earth for curing.

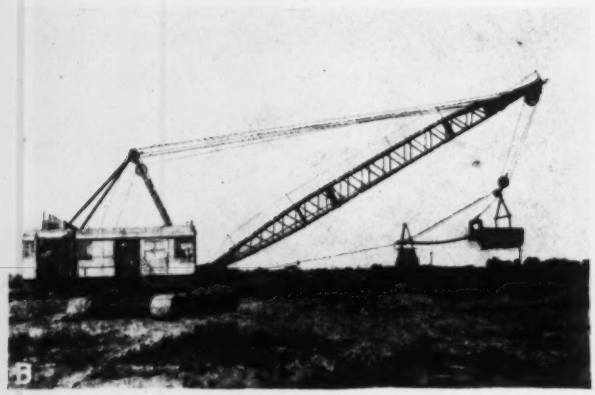
For the first time a new combination in slab-finishing machines is available, providing two screeds and a tamper, where a single screed and tamper or two screeds alone were formerly available. It is significant to note that one manufacturer in making this change designed the improvement so as to be attachable to finishing models produced during the past five years.

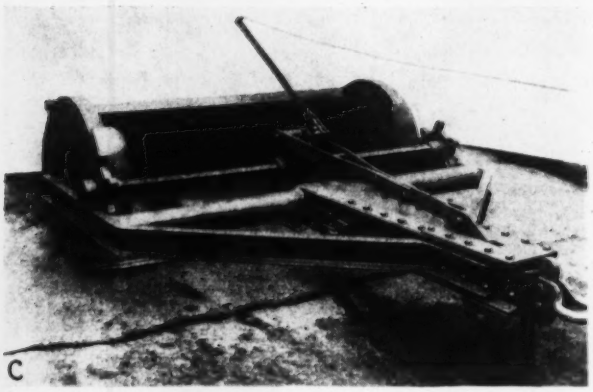


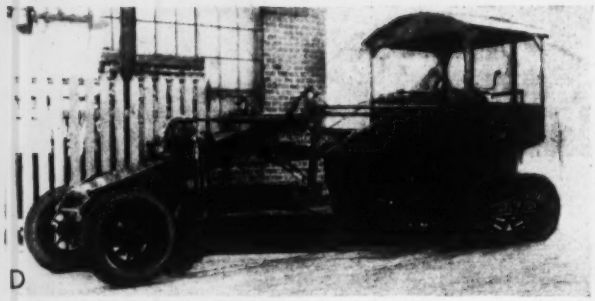
Typical construction machines improved or developed during the past year

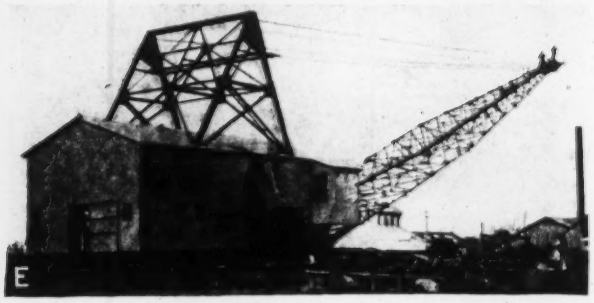
A: Bucket loader equipped with weigh hopper with accurate dial to weigh batches for pavers. *B:* Power control for manipulation of blade and scarifier on auto-patrol road grader. *C:* Patrol mounted on dual pneumatic tires in rear, single pneumatics in front. *D:* Rigid 8-in.-base steel road form built to carry heavy finishing machines. *E:* Batcher plant for handling bulk cement. *F:* New design elevating grader built around tubular-steel backbone instead of on structural frame. Separate engine drives elevator. *G:* 5-yd. dump wagon on crawlers and equipped with automatic spring wind-up on dump doors. *H:* A late-model pulled road maintainer controlled from tractor seat.

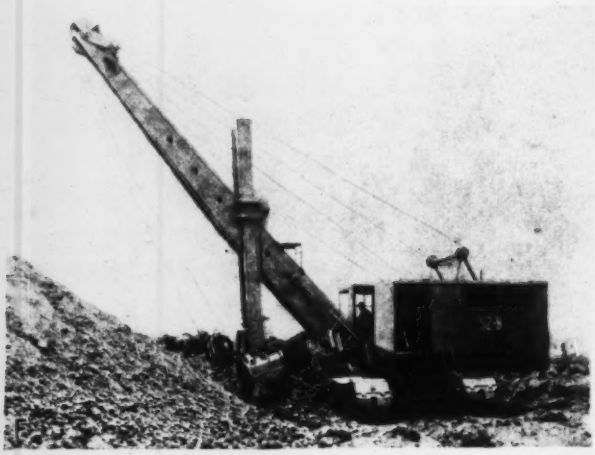


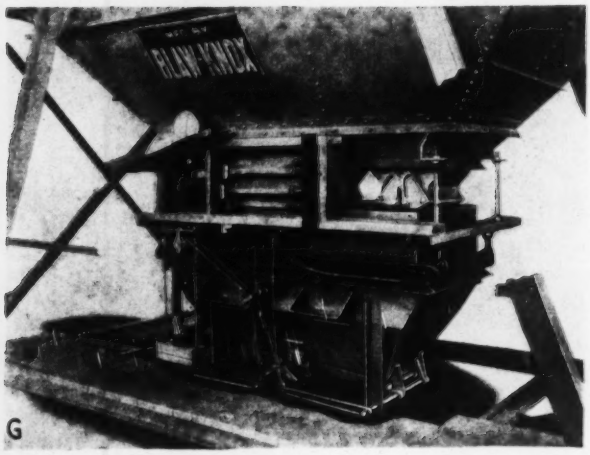












Typical construction machines improved or developed during the past year

A: Portable combination crushing and screening plant. *B:* New 3-yd. diesel dragline on crawler mountings. Controls are air operated. *C:* 2-yd. rotary fresno scraper, an automatic cut-and-carry tool. *D:* High-speed motor-patrol road grader with new rubber-track crawlers. *E:* Largest walking-type dragline, 8-yd. capacity, full diesel drive, 160-ft. boom. *F:* $2\frac{1}{4}$-yd. diesel shovel. *G:* weighing batcher equipped to handle three aggregates.

By slight adjustment to screed members in a standard concrete slab-finisher, a bituminous material-finishing machine is produced, resulting in uniform spreading and smoother surfaces than formerly obtained by hand-raking methods.

Last year saw the introduction of the self-contained paving unit for bituminous roads. These machines combine the loader, crusher, mixer, distributor and finisher.

The high-speed self-propelled road graders, known as motor patrols, have become more prominent. Rubber-track crawlers and dual pneumatic tires are both used in traction drive of these machines. One manufacturer has introduced a power control on the motor patrol, permitting manipulation of the blades without manual effort. One-man high-speed operation is the result.

Improvements have been made in the pulled grader. A significant point of design is that now some of these machines are built with the power and flexibility of a specific tractor in mind, resulting in obtaining maximum capacity from both the grader and tractor. Power take-offs instead of hand-operated attachments now perform the task of handling the blades.

Dirt-Moving Equipment

The career of the elevating grader is most interesting. This well-known dirt mover was first brought out in 1866. Popular from the start, these machines enjoyed steadily increasing sales for many years. About 30 years ago sales started to slack off, reaching a low point five years ago. During this period tractors had largely replaced horses and mules as motive power. Attempts were made to increase the strength of the elevating grader to stand up under the powerful tractors, but interest in the grader waned until the elevator drive was changed from bull-wheel power to power takeoff from the tractor. The next logical step in improvement was the adoption of auxiliary power units for driving the elevator independent of traction power. As a result the elevating grader is coming back and taking its former place as a leader among economical dirt movers.

All manufacturers have improved the grader along with the addition of auxiliary power. An entirely new design elevating grader appeared recently. This machine is built around a tubular steel backbone, eliminating the usual structural frame.

Crawler Dump Wagons

It is certain that the elevating grader never would have revived in popularity if it were not for the development of the dump wagon. Mounting the dump wagon on crawler treads was the greatest step in improvement. This provided a large-capacity unit easily handled in tractor-pulled trains, a unit that could traverse fairly soft ground under full load without stalling. Power wind-up of dump bottoms, sometimes controlled from the tractor, was an important development. An automatic spring wind-up appeared recently. The energy of a dumping load winds up a heavy spring, and the doors remain open until a dog is released at the will of the operator. The spring then closes the bottoms, automatically dogging them closed. Another type of power wind-up permits the opening of the doors any desired amount to aid in spreading the material.

The development of the dump wagon has not been limited to the wagon or cart type alone. Dump trucks of the tractor type and self-propelled dirt-carrying units have been brought out and perfected.

Power scrapers and power-operated scrapers are gaining both in size and favor. The rotary type, an adaption of the old fresno, is a recent development. The old wheeled scraper has grown to large proportions, a 7-yd. model now being available, handled by the largest size tractor. Another 7-yd. grader, of the wagon type and mounted on crawler treads appeared for the first time at this year's road show. It is designed for operation with a 60-hp. tractor and is a one-man machine. The bucket is manipulated by an auxiliary engine.

Shovels, Cranes and Draglines

Convertibility is the keynote of development in power shovels. All the new models brought out by almost every manufacturer during the past year can be converted from a shovel to a crane or dragline. A prominent swing to diesel power is noticeable, especially in the larger units. Some manufacturers are offering a choice of power units, gasoline, diesel or electric.

Draglines continue to grow in size. An 8-yd. machine of the walking type, said to be the largest ever built, is ready for service on Mississippi River levee work. It carries a 160-ft. boom and is powered by a five-cylinder slow-speed diesel engine. Although the rig weighs 550 tons, the weight is distributed so as to produce a maximum soil pressure on the base of only 1,000 lb. per sq.ft. Conforming with the general trend, the machine is equipped throughout with frictionless bearings.

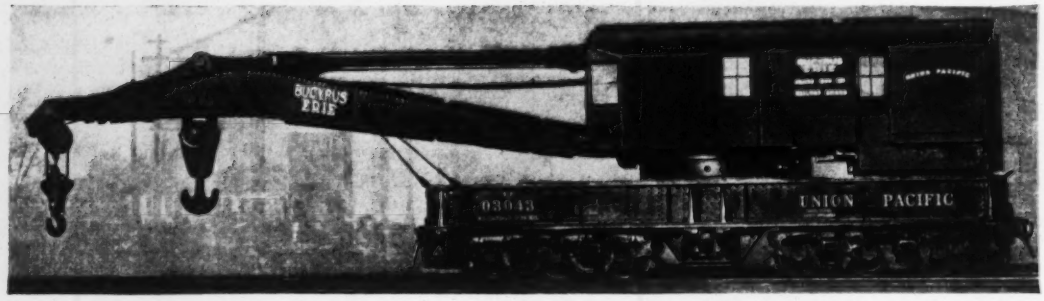
Another company has just announced a 3-yd. dragline operating on crawler treads. This machine is powered by a six-cylinder slow-speed full-diesel engine. All controls are operated by compressed air.

All the new shovels have been designed with the idea of maximum output at low cost. The diesel engine is proving to be an ideal power unit for this purpose. Smaller shovels are sticking to the gasoline engine to maintain speed in operation. The old reliable steam shovel is not neglected in the trend toward more efficient machines. One shovel of this type, brought out last year, combines the strength and digging capacity of a 1½-yd. machine with the speed of a much smaller rig. In the larger size shovels a 5-yd. model has been introduced as a running mate for the long-popular 4-yd. size for heavy work. A 2½-yd. diesel shovel has been designed so it is possible to ship it on an ordinary flat car without dismantling, a distinct improvement for the contractor working on a country-wide scale.

All advantages of frictionless bearings, light alloy steels and improved power units appear in the new lines of small excavators, ditchers and trenchers. Portability is a feature of these small machines. Like the heavier machines, the light shovel is convertible to a crane or small dragline. Inclosed gear and transmission units are becoming standard in these machines.

Concrete Equipment

In the smaller sizes of concrete mixers the aim has been to produce machines lighter in weight and more easily portable—accomplished without loss of quality by using higher-grade materials. In the larger sizes the mixers are designed to get the maximum output per season. This is a change of attitude toward performance, as much attention has been given in the past to hourly output, ignoring delays due to shutdowns. Water control in mixers is being given much attention. Delicate measuring devices have been developed and incorporated into



A 200-ton railroad crane—a product of 1930

the mixers. One manufacturer is using a dual tank to obtain greater accuracy in water measurement.

The cycle of charging, mixing and dumping has been speeded up and coordinated. In some pavers the three operations are synchronized to some extent, allowing the drum to be charged while the concrete is being discharged, without sacrificing the full time of mixing. Definite control of the mix is the aim of many other improvements.

Batching plants have been developed to give exact control of the proportioning of aggregates. Accurate weighing beams and dial scales have been placed on all batchers. Multiple scales permit the handling of several aggregates in one plant. Batching bins are now made portable for easy transportation from job to job.

The increasing use of bulk cement has made necessary the development of accurate weighing and batcher plants for this material. Separate compartments for bulk cement have been installed on batcher trucks. Improved unloading devices have been devised for handling bulk cement from cars and barges. Some of these are pneumatic in operation; others are purely mechanical.

Several improvements have been made in truck mixers. The latest of these models provides that the truck operator has no control over the mixing action or the introduction of water into the mix, both these functions being automatic. Quality concrete is now obtainable by truck mixing. The size of truck mixers has steadily increased, until now 5-yd. models are available.

Other Equipment

Portable crushing and screening plants have been developed to meet the need of widespread highway construction. These incorporate the latest in bearings, inclosed gearing and power units.

Bucket loaders have been improved to the point where some of them are now equipped with weighing hoppers to be used in proportioning materials.

The principal advance in belt conveyors has been toward providing more troughing action in the transportation of materials. Self-aligning bearings also are an improvement in this type of equipment. The portable belt-conveyor units for use in series or trains is a development that has reached a perfected stage in the last year or so.

Sealed bearings, quicker dumping action and extensive use of special alloys for abrasive parts have been the chief recent improvements in clamshell buckets.

For years the 60-hp. tractor was the maximum size. But recently, with the development of larger and larger pieces of equipment to be handled by tractors, the old 60-hp. size is being surpassed. Much attention has been given the power units for tractors. Some manufacturers are providing removable-cylinder engines.

With the increasing weight of machines operating on road forms has come the development of the now standard 8-in.-base steel form. Increased rigiditiy is found on all forms brought out during the past year. In addition to the well-known road form for concrete pavements, there is now appearing a steel form for asphalt roads. Steel forms for general construction are usually made on order only, but new means for quicker setting and moving have been developed in the past season.

An example of the development of a hitherto unknown piece of equipment is the new mud jack for raising sunken paving slabs. The machine consists of a combination mixer which mixes mud, cement and water, and a pressure pump which forces the mixture beneath the pavement through holes drilled at proper intervals.

Credit for much of the information contained in this article is due the following companies: National Equipment Corp., Blaw-Knox Co., Austin-Western Road Machinery Co., Western Wheeled Scraper Co., Allis-Chalmers Mfg. Co., Barber-Greene Co., American Hoist & Derrick Co., Chain Belt Co., Ransome Concrete Machinery Co., Bucyrus-Erie Co., Monighan Mfg. Corp., Caterpillar Tractor Co., The Galion Iron Works & Mfg. Co. and the Lakewood Engineering Co.

Ball and Roller Bearings in Construction Equipment

Four leading manufacturers of ball and roller bearings report that they have furnished frictionless bearings for nearly all lines of construction equipment. As an example of the rapid expansion along this line, one company reports an increase of 20 per cent in sales to the construction industry during the past nine months. Another manufacturer states, "It has been our experience that the use of anti-friction bearings in construction equipment has grown tremendously in the past few years, particularly heavy-duty roller bearings, which are able to withstand the hard service to which these units are subjected and which eliminate the necessity for frequent oiling—something which is almost continually neglected by the user in this field."

The machines equipped by the four companies include: power shovels, cranes, draglines, excavators, ditchers, pavers, concrete mixers, hoist sheaves and blocks, tractors, heavy-duty trailers, portable saws, pneumatic equipment, asphalt plants, hoists and derricks, road rollers, gasoline and electric power units, wheel and power scrapers, clamshells, trucks, road graders and maintainers, and locomotives.

The four companies reporting are the New Departure Mfg. Co., the Norma-Hoffmann Bearings Corp., the Timken Roller Bearing Co. and SKF Industries, Inc.

How Equipment Builders Serve the Construction Industry

By LION GARDINER
President, Lakewood Engineering Co.
Columbus, Ohio.

CONTRACTORS would be virtually helpless without the whole-hearted support and cooperation of the equipment manufacturers, with their resources of technical knowledge, experience, and willingness and capability to serve. Few buyers or users of construction equipment realize or fully appreciate the set-up and operation of the organization behind the placing of a modern efficient and useful piece of construction machinery in service. This article discusses the relationship between the equipment manufacturer and the equipment user and outlines the working of the equipment industry. —EDITOR.

IN A relatively short period of eighteen years, the term of the writer's identity with the construction-equipment industry, tremendous changes, new influences, greater efficiency and a better organized technical study of mechanical design, with respect not only to labor saving but to engineering results as well, have been realized. The common purpose of achievement has brought manufacturers, engineers and contractors closer together, created a better opportunity for cooperation and developed the realization that in reality they are all on one side of the fence striving honestly for better and more economical results. This better understanding is reflected in greater participation by manufacturers in technical meetings and by representation on committees which give them an opportunity to express their views. Their views today are accepted—as they rightfully should be—as an effort to contribute to the industry first, rather than to the individual.

More and more are manufacturers drawing men from the engineering and contracting organization of construction activity, men who have had specific technical training, to assist not only in more intelligent sales application of machinery or material but for the purpose of interpreting the future needs and guiding the experimental work toward new developments. Manufacturers cannot often afford the necessary laboratories to carry on such experimental work, and the whole-hearted cooperation of the state and federal government technical and testing organizations has done much toward assisting in experiments and furnishing data that have facilitated and made possible many refinements and improvements in construction equipment in the past ten years.

Equipment Requirements Varied

The equipment requirements of the construction industry are truly varied, produced by hundreds of different manufacturers, none of which has a great volume of business in any one item solely identified with construction. In view of this lack of volume the amount of money yearly expended in new and improved models and in experimental and development work is surprising. It is not always commensurate with the business involved, and in proportion to sales volume there are not many industries as active in this respect as the construction-equipment industry. Perhaps it is the leadership of the engineer and contractor, constantly striving for bigger and better things, that has created the urge among manufacturers to do more than keep pace with their thinking. That they have done so is well exemplified by the development of road-building machinery during the past decade to meet the fast-expanding national program.

The equipment industry is, in many respects, a secondary rather than a primary industry. Seldom can its members create or increase their markets other than through competitive efforts. To illustrate: A market for a new household device may be developed and a demand created through a proper advertising campaign. But no amount of advertising can create a demand for more concrete mixers, for example, unless the cement industry can increase the use of cement, and to do this to a marked degree again depends upon general business conditions. Also, there is often a misconception of the yearly demand for the various types of equipment required to carry on our construction work. This has resulted in over-production in far too many lines of manufacture, which might be controlled if more associated groups of manufacturers were formed to collect statistics as to yearly requirements and make public accurate information as to the actual demand. Certain groups have been doing this for years, and such data have influenced at times new prospective entries into an over-produced field and prevented unwarranted expansion.

Such groups of manufacturers have a still further fundamental influence for good in the industry through standardization of sizes and ratings. This, without restricting individual initiative, eliminates a purely competitive race in the development of new models and sizes—a race which tends only to increase cost through greater inventories to the manufacturer and unnecessary obsolescence to the owner. Furthermore, unrestricted competitive development of new models can in no way increase volume.

The Associated General Contractors and the American Road Builders Association have already done much through their membership toward offering their offices as a neutral, yet vitally interested, party to help in the formation and development of such groups. Particularly in times such as these it is well to think in terms of the possibilities offered through such cooperative work.

Industry Keeps Pace

During the past years the equipment industry has kept well abreast of the best thinking in design and production methods, in spite of the fact that long assembly lines and mass production are the exception rather than the rule. The influence of automotive design is everywhere evident in the use of alloy steels, frictionless bearings, higher-grade materials and better machine-shop equipment. This has resulted in freedom of breakdown and the securing of longer life from equipment in which the

manufacturers take pride. Thorough testing of models before being sent into the field, careful shop inspection and bonuses to workmen for accurate work and assembly all tend toward a better product with more satisfactory field results.

To a great degree, with the possible exception of motive power and some standard accessories, most equipment is built entirely within the average plant producing construction machinery. Plant investment is increasing and with it a sense of responsibility in the product and the follow-up service, which was not available ten or fifteen years ago. The factory-field organization, made up of men trained to apply intelligently and in the most efficient manner the product for which they are responsible, is much further advanced than in past years, and these same men today are constantly transmitting back to the factory suggestions for improvement of existing equipment and pointing out the possibility of new applications to effect new economies.

Sales Organization

Combined with the factory force is the field sales and distribution organization, which is of two general classes: first, the direct factory sales force; and second, the equipment distributors. At the present time it is safe to say that a far greater volume of equipment is placed through the distributor organization than through direct factory salesmen, though both systems of distribution or combinations of them are generally used.

The last fifteen years has seen a remarkable growth in the size, dependability and responsibility of the distributing organizations, many of them frequently doing a gross business in excess of some of their principals. This volume has made possible the warehouse facilities, service repair parts stocks, new stocks of complete units for prompt delivery, 24-hour service organization, and the credit and financial responsibility that are common today. Of the large group acting as the intermediary between the manufacturer and the customer, it is doubtful if there were a dozen in the country fifteen years ago capable of rendering the service now available.

The so-called "desk agent" of the past is not today the factor in the distributing link, as the demand for prompt shipment from local stock of certain items and the quick repair business and service require warehouse facilities and organization not previously available. The successful distributor of today is not a catalog salesman. Many of them have had engineering and construction training, enabling them to talk the language of the contractor or engineer and to think with him in solving his problems.

A strong distributors' organization exists for the purpose of improving their business conditions and trade practices, and generally informing each other as to ways and means of building stronger and better service. They frequently visit the factories of their important accounts to get first-hand information.

A sales meeting at a factory with 150 men from distributing organizations scattered from coast to coast is not an exceptional event, and these men are there to learn through lectures and demonstrations the way to apply the products, to sell intelligently on merit—all from a personal knowledge rather than from mere catalog specifications. This is building up an efficient and permanent distributing organization, which is rendering the construction field a real service not available in years past.

To back up these distributors most factories have what might be termed district supervisors of equipment, men who are in more frequent personal contact with the factory and able to assist in general and special applications. These direct factory supervisors are further augmented by factory field service men and distributors' field service men, whose part it is to cover the actual installation in the field of the more complicated or special application machines. It is their job to acquaint the contractor's operating force with the machines, the work they can do and their operation and maintenance, thus assuring for the contractors the maximum return from equipment investment. The volume of business may not always warrant such permanent factory men. Their territories vary in size, but in general most factories attempt continued field contact through the year, not only with their distributors but with their customers as well. This is the best way to get first-hand information as to conditions, field performance of equipment, specification changes and other data necessary today to keep abreast of the ever-changing demands and requirements of the engineers and contractors in the construction field.

Meeting Competition

Competition is keen, not only because there is a general over-supply of equipment produced but because there is a keen competition in brains, trying to effect new mechanical improvements that will win a market. Generally speaking, pure price competition does not enter into the industry to a degree to cause great concern. Prices today are barely commensurate with a fair return to the manufacturer, providing both he and his distributor are constantly alert. There are exceptions, of course, but perhaps if the customer would realize that the old adage relating to the value of a satisfied customer to the manufacturer or distributor were turned to read "the value of a satisfied manufacturer or distributor to the customer," there would be less attempt to hammer down bids to the point where there is no profit left for the manufacturer or his distributor.

Contracting is an industry where the time element is most important. Large inventories of parts are constantly maintained by the manufacturers, many times stocked at several centralized points throughout the country, in addition to the factory stock to give prompt service. These manufacturer's repair stocks are in turn augmented by individual distributor's stock for each territory. These repair stocks represent a large investment, but prompt service must be available for breakdowns. A breakdown or the failure of a piece of equipment to perform must be rectified quickly, perhaps in the middle of the night. Whether or not the fault lies with the manufacturer or the distributor, such service is usually gratis, a part of the original transaction, and must be carried on out of the profits therefrom. A reasonable profit is a protection for constant and continued service to the customer, worth many times more than the last five per cent which might be shaved from the fair purchase price. The equipment industry is essentially one of constant service in all its ramifications, and the words of appreciation that come to it seemingly but seldom are all the more appreciated.

True again, the competition is keen, but there seems to run through the men who make up the whole construction industry a spirit of camaraderie that makes up perhaps for some of its drawbacks. It is gratifying to feel that a real part in the building of the country is taking place in our particular factories, on our drawing boards and in our sales and distribution organizations.

Origin of New Designs and Improvements

How Ideas Advance to Reality in Equipment

By KENNETH M. TALBOT
Director of Research, National Equipment Corp., Milwaukee, Wis.

IMPROVEMENTS in construction equipment keep pace with advances in construction technique—and *vice versa*. Neither can get far ahead of the other. New construction methods call for new and improved designs in equipment. Again, new construction machinery produced by an alert equipment manufacturer permits new and more efficient construction procedure. Constant research is required on the part of the successful equipment manufacturer today. He must remain in close touch with the field to keep posted on actual conditions and needs; he must be quick to recognize possible new designs or changes in existing design to meet required performance, and he must equally strive for new designs that will pave the way for new construction methods. And, perhaps most important of all, the equipment producer must at all times work toward improving existing machines to meet the constant demand for increased efficiency. This article tells how new designs and improvements originate and are developed. —EDITOR.

NEW IDEAS and new machines are seldom developed wholly by an individual. Finished machines are the result of development of one or more suggestions.

No machine can be developed without a full appreciation of the field of its use and the problems of the user. From time to time machines not fitted for the work in hand reach the market but do not last long. Within a year after the machine has appeared it has either failed because it is not economical, or it has survived because the economy of the machine is apparent and the difficulties in coordinating its work with that of other equipment have resulted in new methods and in the development of new equipment to work with the machine. The slab-finishing machine in common use today on concrete pavements is an outstanding example of a piece of equipment that was economical but which, in order that the best results might be obtained, required a complete change in forms and methods.

The rise and fall of the belt-conveyor loader several years ago is an excellent example of a machine that had a rapid development and just as rapid a death. At that time it was the practice in constructing pavements to dump the aggregates on the subgrade, reload by hand and wheel to the mixer. Under the circumstances the belt-conveyor loader met two very important requirements by eliminating the wheelbarrow and the necessary runway plank and by making possible the more accurate proportioning of concrete ingredients. But there were outstanding difficulties connected with this operation, such as the tendency to get clay and mud into the aggregates, and interference in obtaining a proper subgrade when the materials were dumped between the forms. Thus a machine that enjoyed a ready sale in one year had no market in the next, for there came a demand that the materials be kept off the grade and discharged directly from the truck or a batch box into the mixer hopper. This demand was met by the manufacturer by the development of a mixer skip sufficiently wide to accommodate a contractor's truck. A change in methods had here required a change in equipment. It is apparent, therefore, that new machines must be developed to meet field conditions at any particular time. Woe to the manufacturer that is too far ahead or too far behind the demand.

New Ideas From Contractors

It is probable that most of the new ideas originate with the field force of the contractor, not as completed ideas but as expressions of desire for a machine to do a certain type of work. It is just as probable that this wish had been expressed a good many times before a contractor, superintendent or machinery manufacturer even put the desire into a preliminary form; for demand, desire and finance must be brought together before there can be a machine.

The public official and the field engineer are prolific sources of suggestion for improvements. The engineer's ideas are usually the result of thought toward the economy or quality side of construction rather than the practicable application alone. Although the engineer may have reduced his ideas to a drawing, there still remains the need of development by the manufacturer. Further ideas come to manufacturers from their own field engineers, field demonstrators, distributors and field managers—men who are responsible for seeing that the manufacturer's equipment operates satisfactorily. Such ideas may result from a suggestion by a contractor's organization or by an engineer. The manufacturer is always interested in methods of obtaining better results from his machine. It was a contractor operating his own shovels that first developed the self-propelled crawler cart and then the wagon. As a shovel operator he appreciated that he could not obtain maximum efficiency from a plant without proper hauling equipment. Both these machines have found their place in hauling excavated materials.

In the same way representatives of engineering and research departments, coming in contact with the field, develop needs for new equipment. Shop and office employees, because of their interest in the company's affairs and through their contacts, often bring in valuable suggestions. Other suggestions are received from time to time from those who have studied the problems and taken out patents on some improvement or new form of equipment. But the most valuable contribution comes from those executives of the business who, through their broad experience, evaluate the advantages of the different types of equipment.

It is fair to say that new designs are in every case the result of intimate contact with field conditions. Only through this close contact can a manufacturer offer to his trade new ideas that are to be money makers for the

contractors. Only through the appreciations of the demands of the field can the manufacturer eliminate that undue time of consideration and experimentation, the prolongation of which in some instances has made machines obsolete, due to changes in construction methods before they were completed.

Wild ideas have no place in the industry, and before a machine can be really developed and marketed there must be an assurance that the market is sufficiently broad to provide a demand for a number of machines. Further, this demand must be of a nature that will continue allowing the machine to be improved from year to year. Many machines have been built by contractors for their own use that fit particular conditions, but they have not a potential possibility because of lack of market. On the other hand, machines have been developed that have immediate market possibilities. Among these might be mentioned the mud-jack, developed in 1930 in Iowa, for raising concrete pavements that have settled.

Continuing Improvements

If it is apparent that a market can be developed, it is necessary not only that the manufacturer produce a finished machine but that he assume the obligation of keeping abreast of the ever-changing demands of the construction industry. As an example, the experience of a branch of the writer's corporation might be cited.

From 1919 to the present time the firm has designed, built and marketed eleven models of paving mixers, of which only two are offered at the present time. In the last nine years it has designed, built and offered to the public ten different shovel, crane and dragline combinations, of which it offers five today. From a narrow-skip machine having a capacity of 11 cu.ft. at a maximum speed of 30 batches per hour with a 1-min. mix, there has been a continuous development to the present 27-E paver having a capacity of 30 cu.ft. of concrete at a speed of 48 batches per hour. The small machine was manually operated; the present machine is fully automatic, thereby giving the advantage of seconds saved to the owner. This is development that has been caused by an increasing demand in the industry. In the same way the power shovel has been developed from an open-cab, open-gear machine to a fully inclosed machine with all gears running in oil. Speed of operation, economy of fuel for work done, longer life and better materials justify the changes that have been made as the years went on.

During 1930 our corporation developed seven new machines. The cost of this development can be justified only by an ability to meet the existing requirements. Because of its very nature and because of the characteristics of the men in the construction industry, the equipment field is extremely competitive, not only in sales of standardized machinery but in the development of ideas that will better meet the requirements.

Obligation of Manufacturer

It is not possible to combine in any one statement the obligation of a manufacturer of heavy machinery to his stockholders, agents, customers and to his organization; but the following, although not always possible of attainment, may be suggested:

To offer to the trade through the usual channels of distribution machines that fulfill the requirements of the existing demand as to size and speed, with capacity made possible through simplification of controls, so that maximum results may be obtained. Thus, the manufacturer must offer new machines to meet new needs as these needs develop. The meeting of this obligation requires constant research.

Industrial research is a term that has been loosely used. Perhaps the very definition of the word research, as found in the dictionary, may be responsible, as it is defined as "continued and diligent investigation." This type of research must, to be effective, be continued for more than a day, a week, or a month. It must be diligent, for there is no measure of its success over short periods; and unless there be continued diligence, success cannot be attained.

Duties of Research Department

If we sense the opportunity of such an organization, we believe a research department to be a department whose duty it is to fill the gaps in the manufactured line that develop in the evolution of business; a department capable of looking into the future of the business and considering all factors affecting the continuity of the business; an organization that watches the application of the machines to the work at hand and is interested in new machines and in new methods. It should be a department whose duty it is to spread the leaven of improvement by the development of methods of doing work that make present methods obsolete; an organization in constant contact with engineers—men who are interested in results obtained from the machine rather than in the machine itself. A research department should be capable of rendering real service to the agents, as well as to the sales, engineering and service departments of the manufacturer, by pointing out trends; a department that by its very separation from the immediate problems of the business—production, service and sales—can plan for the future. Lastly, it should be a department that has a vision of the market, of construction, of developments, and that can justify its position by recommendations that will earn real profits for the company and for the sales organization.

The responsibility that rests on any man who brings new lines to an organization is great. To develop any major piece of equipment and get it on the market will cost from $25,000 to $150,000. There are outstanding examples of equipment now in use that cost a great deal more than this to develop, and which, except for the enthusiasm, drive and perseverance of the manufacturer, would never have been brought to final completion. If a manufacturer is to meet conditions in the field, he must have throughout his organization the spirit of continued and diligent investigation—which is research.

Thames Bridge to Be Widened

The London county council has awarded to Dorman, Long & Co., Ltd., of Middlesbrough and London, the contract for widening the existing Putney Bridge over the Thames. The contract, which was let for £337,000 (about $1,600,000), involves widening the bridge by 30 ft. over its entire length; 28 ft. will be added to the roadway, and 1 ft. to each of the two footways. There will be four new caissons and two new abutments, and the new foundations will be subjected to a test load of 3,000 tons before they are joined with the existing piers. The work will probably occupy two years.

Equipment's Place in Tunneling Progress

By JOHN S. MACDONALD
Vice-president, Patrick McGovern, Inc., New York City

THE ACCOMPLISHMENTS of modern hard-rock tunnel driving—economy, speed, safety and quality of work—are the result of the development of adequate and dependable tools and equipment. Each class of equipment used in tunneling today has had a definite share and responsibility in advancing the art of tunnel construction to its present efficient status; to a degree of performance that makes economically possible the driving of bores of extraordinary length or of exceptional difficulty.

The drilling speed of the modern rock drill is a prime factor in the economies of tunneling. Progress, and likewise cost, of tunnel driving is dependent upon the speed and coordination of the cycle of three elements—drilling, shooting and mucking out. Of course due allowance must be made in poor ground for timbering. But this is a factor controlled entirely by inherent conditions every foot of the way. As labor costs comprise a large percentage of the cost of drilling, the speed of drilling is a considerable item toward the cost of tunneling. For given rock conditions drilling power and steel consumption remain practically constant per foot of hole drilled.

Fast or economical drilling would be impossible without the mechanical drill-steel sharpener. To maintain an army of blacksmiths necessary to sharpen by hand the thousands of steels required on a modern tunnel project would, at present wage rates, be prohibitive in cost. The oil-burning furnace in which the drill steels are heated has made possible the operation of the mechanical sharpener at an economical capacity.

The speed of the second element in the tunneling cycle —shooting—is largely dependent upon the length of time necessary to rid the heading of dynamite smoke after a blast. It is here that modern dependable ventilation equipment has made a valuable contribution to tunneling progress. In clearing out the depressing powder fumes and supplying the headings with adequate fresh air, the ventilation plant is invaluable in maintaining the efficiency and health of the workmen. Credit for rapid and efficient shooting is also due the explosive industry, which has developed not only a wide variety of powders to suit every conceivable rock situation but also swift and safe means for firing the charges.

Mucking machines are the heart of the third element in the tunnel-driving cycle. Slow, inefficient and costly hand-mucking methods have no place in the fast schedule of present-day tunnel operations. Shovel, scraper and conveyor types of mucking machines are now available for any size tunnel and are adaptable to any rock and ground conditions. Many of these machines, especially in the smaller sizes, are offered in either air or electric drive.

The dependability of air-compressing equipment today is taken for granted. Thoroughly reliable heavy-duty compressors of both single and compound action have been developed to a remarkably high degree of efficiency. A steady unfailing supply of high-pressure air is indispensable to the economical progress of any tunnel job. Compressed air is a major source of power in tunneling operations. The cost of this power bears directly on the cost of the project.

The great majority of rock tunnels are lined with concrete. Two developments that have brought the cost of lining to within acceptable limits are the pneumatic placing machine and the steel form. Although the concrete yardage involved in tunnel lining is comparatively small, placing by hand is both difficult and exceedingly costly because of limited working space. Pneumatic placing has three important advantages over hand placing—a noticeable saving in cost; better quality of concrete due to the packing effect of the air blast; and a great saving in time. This last factor is of utmost importance in the progress schedule of the entire work.

Regardless of the pneumatic concrete gun, speed in tunnel lining could not be maintained at a reasonable cost without the modern steel form. Built up in collapsible sections, these units ar readily set up, stripped and reset. Labor saved by their use is an important item. In certain cases a special design of steel form has permitted simultaneous mucking and concreting in the same heading, resulting in speeding up completion.

A brief discussion of tunneling equipment would not be complete without mention of water-handling machinery. A modern pumping layout, large installations at shafts, smaller but dependable pumps located at intermediate sumps, and light portable units located close to the face of the heading are necessary to keep the tunnels dry for efficient working conditions. Furthermore, an adequate pumping plant to handle emergency inflows of water is necessary to insure freedom from delays due to flooding, and the safety of the workmen.

Another factor that has had a signal effect in the economy of tunnel operations is the expansion of electric-current distribution. Cheap and dependable electric power for operation of compressors, lighting system, ventilation plant, pumps, hoists, locomotives and in some cases mucking machines has meant much to tunneling. Where electric drive has replaced steam, considerable economy with greater reliability has resulted. Diesel generating sets and direct-connected diesel-driven compressors are proving satisfactory where electric power is not available.

The adoption of modern mechanical tunneling equipment has had an effect beyond that produced by the individual tool—it has created a higher-grade and much more efficient tunnel worker. Mechanization of tunnels has attracted a mechanically minded class of men to the field. These are men that respond to and appreciate organization and schedule.

The combination of dependable and economical equipment and well-trained efficient crews has advanced the art of tunnel construction to its present stage. It has brought the building of tunnel projects within practicable economical limits.

Tunneling Equipment—I

Development of the Rock Drill

The Principal Tool Responsible for Modern Tunneling Methods

By C. H. VIVIAN
Ingersoll-Rand Co., New York City

THE INVENTION of the percussion-type drill paved the way for present-day methods in hard-rock tunnel driving. Since its early development there has been but one significant change in the design of the rock drill—the change from piston to hammer operation. From the idea of the rock drill sprang a wide variety of air-driven tools of similar type, including riveting hammers, clay spades, concrete breakers and tampers. This article traces not only the development of the rock drill but also accessory tools and drill steel. —EDITOR.

THE HISTORY of the rock drill covers only 82 years. Drills of the general type and design now prevailing go back less than 35 years. The rock drill, then, is a strictly modern development.

Prior to 1849 all rock drilling was done by hand. The first mechanical drilling machine was invented by J. J. Couch, of Philadelphia, and improved in conjunction with J. W. Fowle of Boston. It was operated by steam and was so heavy and cumbersome as to resemble a power shovel of today more than a modern rock drill. It was tried out in the Mt. Cenis tunnel through the Alps. In 1867, after the patent rights had passed to Charles Burleigh, it was used in the Hoosac Tunnel in Massachusetts, a 5-mile bore through solid rock.

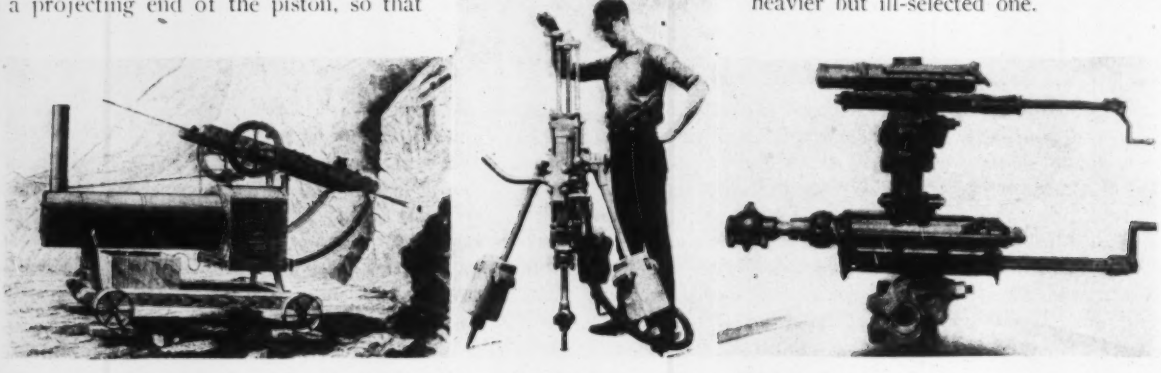
The year 1871 ushered in a period of prolific drill designing. Simon Ingersoll, Wood, Sergeant, Rand, Waring, Halsey and Githens all contributed to it. Primitive hand-drilling methods began to be supplanted by machines. All of these early drills were of the piston type. The drill steel was rigidly affixed to a projecting end of the piston, so that both piston and steel moved through the entire travel of the drill stroke. Such drills were operated by either steam or compressed air.

The modern hammer drill, in which the drill steel is struck by a hammer-type piston while being loosely held and rotated in a chuck, was originated by J. George Leyner, of Denver, in 1896. His design was a reversion to the principle of the single-jack and hand-held steel. Leyner's drill, developed in a mining area, was of the drifter type, intended primarily for drift or tunnel work and arranged for horizontal mounting. Tripod mounting had prevailed until this time.

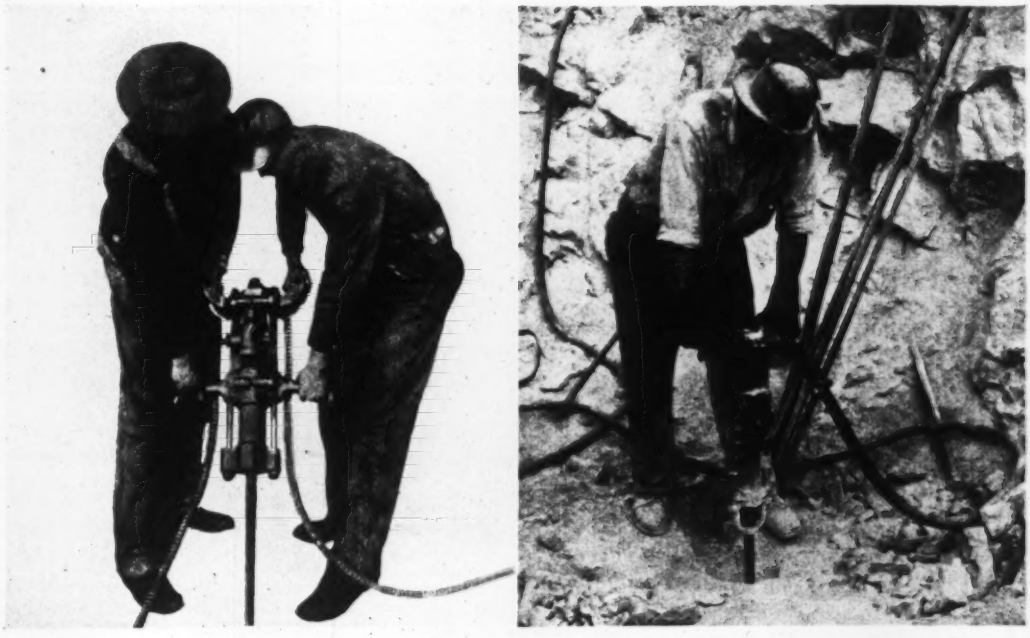
The Leyner drill introduced such improvements as automatic rifle-bar rotation of the drill-steel chuck, automatic lubrication, inclosed throttle control, and hollow drill steel through which water and air were passed to clean the hole. The first effective self-rotated hand-held drill was produced by Leyner in 1909 and was first made with rifle-bar and sleeve-chuck rotation in 1912 under the trade name "Jackhamer."

Present-day drills incorporate the basic elements of Leyner design, modified and improved by various manufacturers. Offshoots of this development include various members of the pneumatic tool family. The rock drill is at least the stepfather of the riveting hammer, chipper, backfill tamper, paving breaker, sheetpile driver and kindred reciprocal air-driven machines.

The modern rock drill is a specialized tool. It is made in a wide variety of types and sizes to provide the most effective machine for any job of drilling. A study of the rock conditions to be encountered, with consideration of hardness, structure and moisture content, is a preliminary requisite to intelligent selection of drills. Depth of holes to be placed will also have an important bearing. The weight of a drill is not alone indicative of its effectiveness. On many applications the correctly chosen drill will produce more footage than a heavier but ill-selected one.



Four stages in the development of the rock drill
Left: Couch rock drill, first of the power type, 1849. Center: early Sergeant tripod drill. Right: Sergeant piston drill of twenty years ago mounted below present-day hammer-type drifter drill.



The old and the new in rotating hand drills
First self-rotating hand-hammer drill shown at left.

The trend of rock-drill design has been consistently toward lighter weight, greater drilling speed and more positive rotation. Marked progress has been made along these lines. The modern drill weighs from one-fourth to one-third as much as the 1900 model and will do from three to ten times as much work. At the same time the air requirement, based on drilling speed, has been considerably reduced.

Today the problem of further progress in these directions is one of metallurgy rather than of engineering design. Speeds of 1,800 to 2,400 blows per minute are now the rule. The effects of both increasing the rate of action and at the same time reducing the metal sections are readily apparent. The sphere of the drill designer is now restricted. He can not ignore the essential features of durability and low upkeep costs to attain lightness and speed.

Experimental drills, using high-pressure air (125 to 175 lb.), have demonstrated that much higher speeds are possible, but more enduring steels from which to construct drills and drill steels must be developed if such drills are to become practicable. The present importance of the metallurgist can be realized if it is borne in mind that steel that is satisfactory for such products as razor blades and high-grade cutlery lacks sufficient purity for making many rock-drill parts.

Higher Air Pressures Costly

Any appreciable rise in the air pressure used for operating rock drills would have the effect of increasing upkeep costs on both drills and drill steels and would entail higher first costs and power costs for compressors. These factors would probably more than offset any savings resulting from faster drilling speed. Furthermore, as drilling speeds are pretty well coordinated with the most effective schedules of blasting, mucking and other essential operations, it would appear that the prevailing standard air pressures of 80 to 100 lb. will be maintained for some time in the future.

Drifter-type drills, which are of major importance in rock-tunnel work, are made in numerous sizes ranging in weights from 115 to 225 lb. Medium-weight types, from 145 to 175 lb., are suitable for most tunnel jobs. Heavier drills are occasionally demanded for large bores in exceptionally hard rock, particularly where long rounds are to be pulled. The field of the heaviest types (above 200 lb.) is in drilling down holes to depths as great as 36 ft. from wagon or tripod mountings and in dimensional stonework from quarry bar mountings. Such drills have been adopted in increasing numbers in recent years for work formerly done by well drills. Wet drilling is the almost universal practice in drifter work.

Stopehammers, which have an important place in some systems of tunneling, range from 85 to 120 lb. in weight and are made in both hand and automatically rotated types and for either wet or dry drilling. Hand-held drills for shaft sinking and bench drilling range from 30 to 105 lb. in weight, those above 75 lb. being ordinarily classed as sinkers. They are made in three general types: dry, wet, and with blower-tube attachment for extra hole-cleaning power.

Lubrication Important

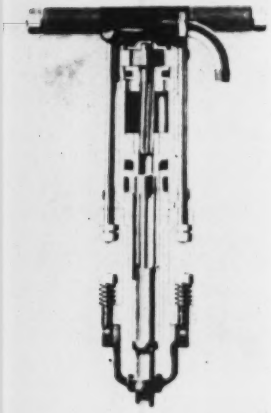
Higher speeds and increased rotative power have placed added emphasis upon lubrication. Several drill manufacturers now furnish airline lubricators with their heavier drills as an inducement to the user to pay proper attention to lubrication. One maker has gone so far as to omit the usual grease pockets from some classes of drills, on the theory that this will insure the use of airline lubricators. These lubricators, made in pint and quart sizes, are placed in the airline about 12 ft. from the drill. Air passing through the lubricator picks up and carries along minute quantities of atomized oil. It is necessary to fill the reservoir with oil only once each shift.

There is no standard practice for drill mountings in tunnel-heading work. The type employed depends largely on the size of the bore, the method of tunneling employed and the individual preference of the directing

engineer. Drill-carriage mountings of various types have been used in recent years in some notable tunnel undertakings, most of them large bores for railroad use. A review of recent tunneling jobs in many parts of the world shows that the crossbar leads in popularity. Its particular advantage is that it can be set up above the muckpile as soon as the smoke from blasting has cleared sufficiently to permit work at the heading. This is but partly possible with columns, while drill carriages cannot be moved into position until the track is cleaned up.

Drill Steels

Increases in drilling speed have proportionately emphasized the importance of providing drill steels that will stand up under the greater punishment, with the result that a great deal of work is being done along this line. The drill steel must absorb the burden of the piston blow, and any increase in the drilling speed or the force of the piston blow obviously quickens failure of the drill steel. Experiments with high-pressure air show that excessive drill-steel breakage is one of the major problems encountered and that this in itself tends to nullify the economic gain resulting from faster rock penetration. Up to now the design of rock drills has progressed faster than the development of drill steels.



Section of modern jackhammer rotating hand drill

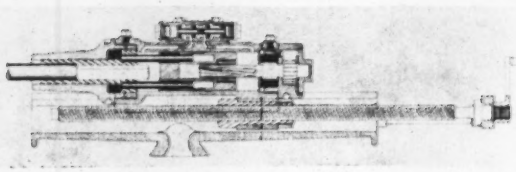
Three essential requirements of good drill steel are: (1) freedom from impurities; (2) uniformity of section and, if hollow, uniformity and centrality of hole; (3) uniformity of composition and correct chemical content to produce effective hardening to meet average field conditions.

Many breakages of drill steel attributed to its faulty composition are undoubtedly due to other causes, which are wholly beyond the control of the steelmaker. Drill users are evidencing a growing realization that correct heat-treating and reconditioning of drill steels materially prolong their service life. Closer attention to these matters leads to better performance of both drills and drill steels, with consequent better drilling records.

Mechanical Sharpeners

The wisdom of machine sharpening of drill steels is now generally recognized. Its principal advantages are: increased service between sharpenings, ranging up to 35 per cent; increases in drilling speed up to 50 per cent; greater conservation of steel through lessened breakage caused by dull steels and too frequent heatings for reconditioning; decreased wear on drills; and easier handling of drills. A sharpener will prove profitable even where only one drill is in service. No sizable tunnel project is carried on nowadays with hand-sharpened steels.

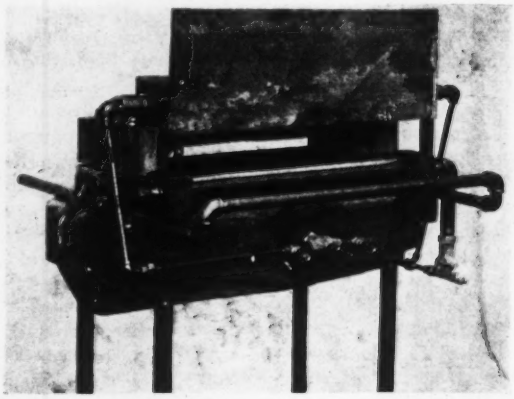
Air-operated sharpeners are universally employed. They are made in several sizes to handle steels of various diameters. In addition to performing all operations involved in making up or reconditioning drill steels, they can, by use of special dies, be employed for forging bolt heads, moil points and scores of other products used on construction jobs. Shank and bit punches for servicing hollow steels are standard attachments. Constant refinements in design are being made, the trend being toward faster-acting and simpler machines which can be operated easily and safely.



Section of first Leyner hammer drifter drill, 1896

The great amount of educational work done by drill manufacturers in impressing upon users the advisability and economy of proper heat control in the treatment of drill steels is having its beneficial effects, and furnaces that will produce the most desirable results are now employed on most jobs of any size. Oil-burning units, which can be adapted to the use of gas, are the rule. Fire boxes are so constructed that steels can be fed from either side if it is desired to place the furnace between two sharpeners to supply both. These furnaces provide for uniform heating by heating in the flame only and largely eliminate injuries to the steel arising from chemical unions with sulphur, phosphorous and other undesirable elements which are liable to take place when coal-burning furnaces are used.

An electric furnace has been developed but has so far been put to only small use because of its comparatively unfavorable economic factors. Its initial cost is six to eight times that of an oil-burning unit, and its operating cost is from four to twelve times greater, depending upon the cost of power. Upkeep costs are also high, replacement of heating elements being the principal item of expense.



Oil-burning furnace for heating drill steel

Pyrometer control of furnaces has been introduced with some success in recent years, and most manufacturers will now furnish standard units with this equipment. Pyrometers are designed to eliminate much of the human element and to standardize temperatures for forging or tempering or both. They overcome the tendency of the blacksmith who estimates the steel temperature by its color to underheat on dark days and overheat on bright days when working in daylight. Thus far, pyrometer control has not been generally adopted, but its use is growing. It was employed on five out of 31 major tunneling jobs recently surveyed.

Tunnel Equipment—II

Water-Handling Equipment for Tunnels

Characteristics of Various Types of Pumps Used in Tunnel Construction

By A. H. BORCHARDT
Worthington Pump and Machinery Corp., Harrison, N. J.

THE SAFETY and success of tunneling operations often depend upon adequate and efficient pumping-plant installations. Proper selection of the right type and size of pumping unit for various situations at headings, intermediate sumps and main shafts or adits, and for emergencies is of utmost importance to both the economy and progress of tunnel driving. This article serves as a guide to the proper selection and installation of pumping units and discusses the characteristics of several types of units. —EDITOR

ALTHOUGH the water hazard is regarded as of primary importance by engineering contractors, past experience shows that much of the excessive expense of tunnel construction is attributable to undue delays resulting from inadequate pumping equipment. It matters little if it is the construction of railway, water-supply, subway or subaqueous tunnels. Drainage control must be considered if the work is to be expedited. Directly and indirectly, thousands of dollars have been lost by contractors through insufficient pumping equipment. Workings frequently have been flooded, causing serious delays while dewatering. Wet or improperly drained tunnels decrease the speed of construction and thus materially increase the driving costs.

The trend in tunnel pumping equipment is always toward smaller and more compact units. Years ago the machinery for a proper tunnel pumping plant was so heavy and required so much space that installations were made with difficulty. The units were not readily movable, and the grades of the tunnel had to be such that there was a gravity flow to the pump suctions. Crank-and-flywheel and large duplex pumps are seldom used now on tunnel drainage service. Compact air-driven single-piston units together with electrically driven centrifugal and power pumps are now most frequently employed for this work.

As all tunneling operations require both compressed air and electricity the contractor has a choice of drives for pumps. For use in limited space, as in headings, the air-driven single pump has many obvious advantages from a practicable point of view. Because of its compactness it can withstand rougher usage and does not require the same protection as an electrically driven unit. Its design permits this type of pump to operate against variable heads, which are limited only by the air pressure available, the dimensions of the pistons and the strength of the liquid end, thus making it a universal and extremely useful type.

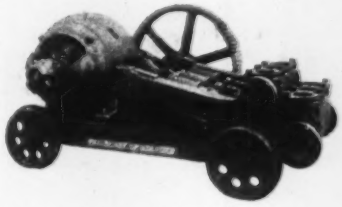


Fig. 2—Electric-driven power pump on rail-truck mounting for emergency use

The electrically driven power pump with truck mounting (Fig. 2) also is widely used for portable work. Where an unexpected seepage of water is encountered and the air pressure is not sufficient to operate an air-driven pump, the electrically driven unit will meet the emergency. As it is also a displacement pump, the head against which this unit can operate is limited only by

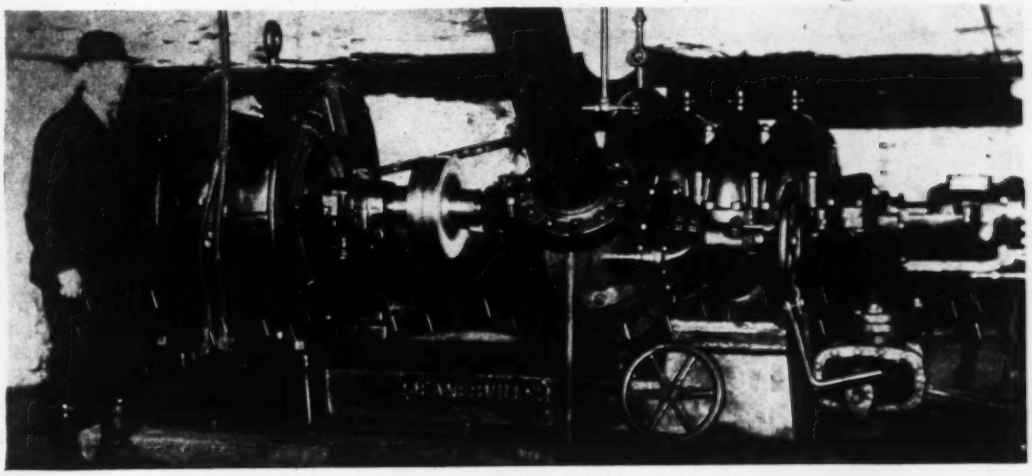


Fig. 1—Electric-drive centrifugal-pump installation at a main tunnel shaft

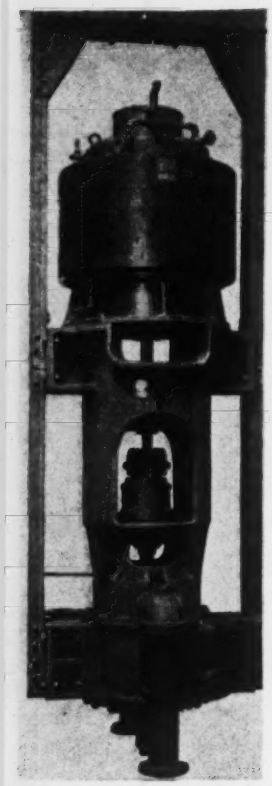


Fig. 3—Direct-action sinking pump, electrically driven

the power of the motor and the strength of the water end of the pump.

In reviewing the history of the development of tunnel pumping apparatus it is apparent that the most marked improvements have been made in the centrifugal units. Not only have there been great advances in the pump itself, but also the electric motors have been equally improved. For safety and reliability in tunnel work it is imperative that contractors take full advantage of these improvements in motor design and construction. To insure economical and, above all, reliable equipment best adapted to the work to be done, the conditions under which the motors and their controls are to operate should be fully explained to the motor manufacturer. The development of vapor-proof, moisture-proof and explosion-proof motors and the availability of completely inclosed starting apparatus has increased the reliability of electric drive.

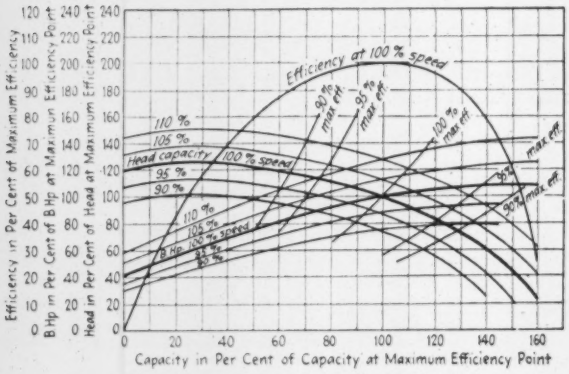

Efficiency in Per Cent of Maximum Efficiency
B Hp in Per Cent of B Hp at Maximum Efficiency Point
Head in Per Cent of Head at Maximum Efficiency Point
Capacity in Per Cent of Capacity at Maximum Efficiency Point
Efficiency at 100 % speed
110 %
105 %
Head capacity
100 % speed
95 %
90 %
B Hp
max eff

Fig. 4—Typical characteristic percentage curve of double-suction volute pump

To a large extent the rapid improvements in centrifugal pump design are due to the perfection of higher-speed motors. As its name implies, the centrifugal pump is dependent on the peripheral speed of its impeller or impeller tips to overcome its pumping head. Its operating characteristics are entirely different from a displacement pump and should not be confused with the latter when making applications.

At any given speed the centrifugal pump will deliver a definite volume of water against a specific head. If the head varies, the capacity, efficiency and brake horsepower of the unit also will vary. A characteristic curve, drawn on a percentage basis, is shown in Fig. 4. On this curve the foregoing relationships of head, capacity, speed, efficiency and horsepower are clearly indicated. Upon investigating this typical curve the importance of accurately determining the total pumping head—if other conditions such as capacity and efficiency are to be established—is obvious.

It also will be seen that, as a portable or general utility unit, the centrifugal pump has its limitations. For example: if the head at any temporary site exceeds the designed head condition by 25 per cent, the pump, when direct-connected to a constant-speed driver, will not be suitable, as it will deliver no water. However, if the actual head is lower than that for which the unit was designed, then it can be used—although at a sacrifice in efficiency. For these reasons centrifugal units give the most satisfactory service in tunnel work when they are located at a fixed pumping site.

There has been a tendency among some users of centrifugal pumps to limit the rotative speed of these units to speeds that really are obsoletely low—speeds previously limited by motor design. These limitations affect the application of modern designs and give the user a more complicated and a poorer pump. What is high speed for one capacity and head is low speed for another. Therefore, a fixed rotative speed never should be specified. Instead, its determination should be left to the manufacturer, who will base it on the actual speed calculated from the correct specific speed for the particular conditions of service.

One of the most important sources of power loss in a centrifugal pump is that of disk friction, or the work expended to drag the impellers through the water surrounding them. Disk friction increases more rapidly with the diameter of the impeller than with the speed. In moderate-capacity high-head pumps this friction may constitute the principal power loss. For the impeller diameter for a given head and capacity varies inversely as the speed, whereas the horsepower lost by disk friction varies as the fifth power of the impeller diameter and as the cube of the speed. If a speed lower than the correct speed is insisted upon, the usual result is a larger proportioned pump. This results in more stages for high-head pumps, lower efficiency and higher maintenance charges.

It is obvious that the tunnel contractor should be guided by the foregoing facts and should install equipment of the minimum physical dimensions and highest economy. He will reduce both initial investment and operating costs consistent with the reliability offered by modern design. The variable conditions of tunnel construction make it extremly difficult to recommend the most suitable type of pump. The amount of water

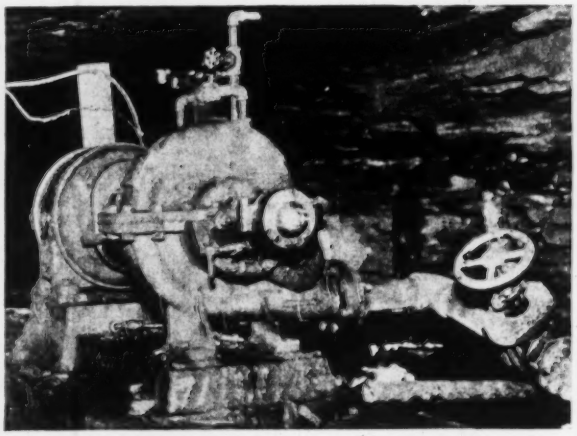


Fig. 5—Typical gathering unit, an electric-drive centrifugal pump

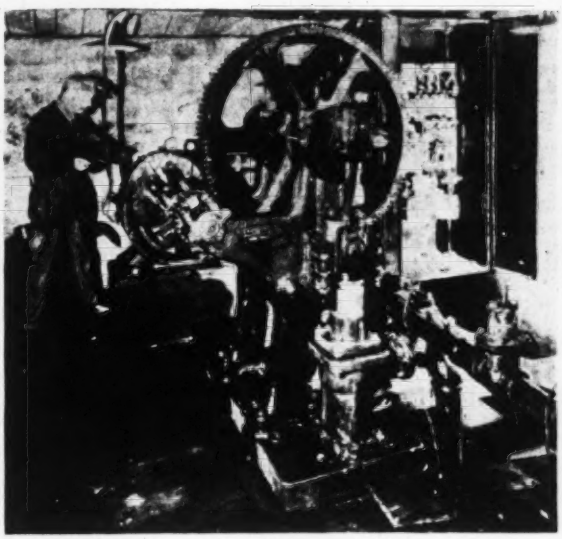


Fig. 6—Motor-driven triplex pump

encountered and the depth of the tunnel below ground will influence the selection.

In driving a shaft to tunnel grade, electrically-driven, air- or steam-operated direct-acting sinking pumps (so-called) are used. In deep shafts where large amounts of water are encountered it sometimes is desirable for safety to install, at intervals of about 300 ft., temporary sumps with electrically driven horizontal centrifugal pumps for surface boosting. This relieves the sinkers of excessive load in lifting to the surface and, if they fail, safeguards the shaft at least up to the location of the sumps. Fig 3 shows a typical electric sinking pump.

In the actual construction of the tunnel the pumping equipment is divided into two classes: shaft pumps and gathering pumps. When used near the headings the gathering pumps usually are air-driven single-piston pumps which discharge into nearby sumps. From these sumps, self-priming or manually primed, electrically driven, single-stage volute pumps, as shown in Fig. 5, discharge through a permanent pipe line to the sumps of the main-shaft pumps. The head against which these booster pumps operate is principally one of friction, and, in selecting the proper pump, this must be calculated. Depending upon the quantity of water to be handled, these pumps may be of the single- or double-suction type and, as a rule, will be standard equipment. Single-stage volute pumps will operate against all heads up to approximately 200 ft. For greater heads two- or three-stage pumps are available.

The main-shaft pumps take the complete drainage of the tunnel, pumping it through the column pipe in the shaft to the surface. As the safety of the tunnel operation is dependent on these main pumps, extreme care must be exercised in their selection. The sumps from which they draw should be large and equipped with baffles to allow sediment to settle. If the sumps are properly designed to maintain low water velocity to the pump suction pipe, the life and efficiency of the pumps will be prolonged.

The type of pump best suited to this service will depend upon the capacity required and the working head. Due consideration should be given to the motor-driven triplex and centrifugal types. For small capacities and high heads the triplex unit has certain advantages over the centrifugal pump. For high or low heads and capacities over 300 gal. per minute the centrifugal unit will no doubt prove superior. Usually the required pumping capacity of the main shaft is sufficient to warrant centrifugal pumps. Fig. 6 shows a typical triplex pump suitable for main-shaft service.

For safety it is desirable to have ample pumping capacity at the main shaft to handle all sudden inrushes of water into the tunnel. Likewise, it is desirable not to have all the capacity in one unit. A good practice, where the capacity is sufficient, is to install three pumps, any two of which are capable of taking care of the normal requirements. For high heads these pumps are of special design, and spare units should be kept on hand.

From the foregoing it is apparent that no one type of pumping unit will meet even the majority of conditions to be faced in tunnel work. Portable and stationary units each have their place. Centrifugal, power, direct-acting pumps—electrically or air driven— must be considered in making a selection where efficiency, low operating costs and dependable operation are to be the deciding factors.

Sinking a shaft or driving a tunnel is not merely a rock and dirt removing operation. Water, with all the damage it can do, all the delays it can cause and all the money it can waste, often represents the difference between profit and bankruptcy to a tunnel contractor.

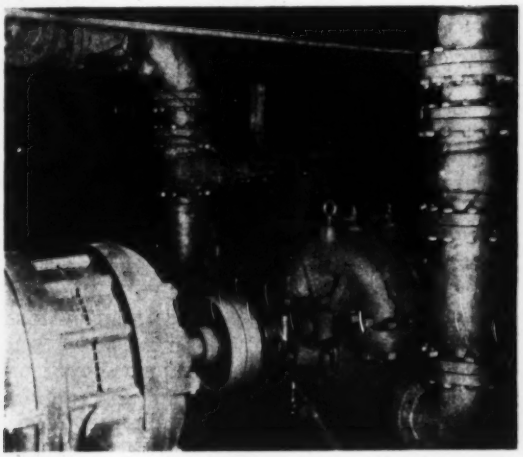


Fig. 7—Three-stage centrifugal pump for high heads

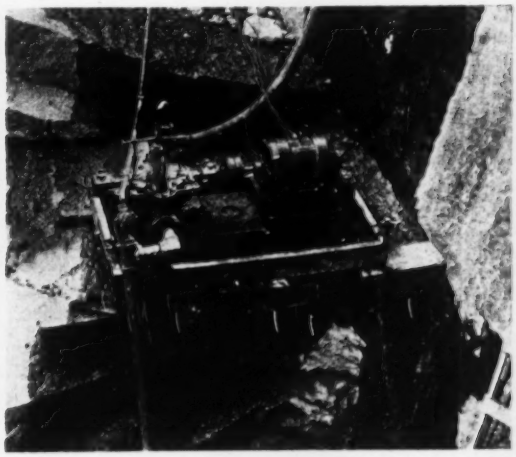


Fig. 8—Centrifugal pump installed for shaft sinking

Tunnel Construction—III

Ventilation During Construction

By R. H. ROGERS
Industrial Engineering Department, General Electric Co.

PHYSICAL FATIGUE and mental dullness caused by poor ventilation are intolerable in efficient modern tunnel-driving practice. The safety and comfort of underground crews require an ample supply of fresh air. Rapid drilling and mucking methods have resulted in more frequent shooting in tunnel driving, increasing the need of adequate ventilation. This article shows how ventilation has kept pace with developments in other branches of the art of tunnel construction. It furthermore points out to the tunnel engineer and contractor the efficiency of various types of ventilating-equipment power units.

—EDITOR.

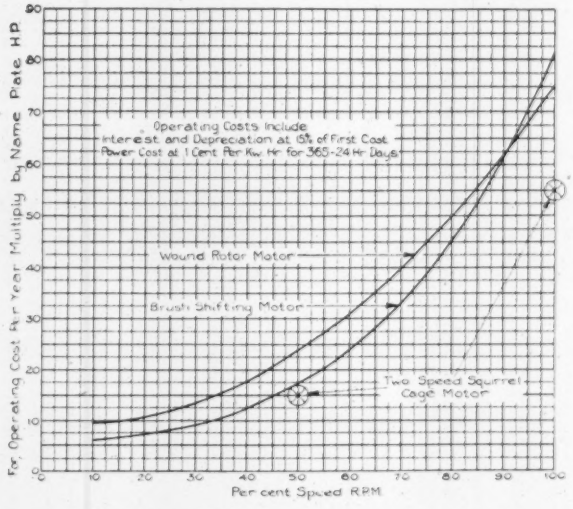
TUNNEL WORKMEN in ancient times waved heavy cloths in the workings in a feeble attempt to provide ventilation by keeping the air moving. In modern tunnel construction the throwing of a switch will put into operation a scientifically designed ventilating plant providing an ample supply of fresh air at the very face of the heading to safeguard the health and comfort of the workers.

There are several methods used for ventilating hard-rock tunnels during construction, and in some cases the method used is modified or changed as the work progresses. In the main the ventilating system is influenced by the distance from portal or shaft to headings, by the size of the cross-section and by the method used in tunneling.

The following methods of tunneling are most commonly used, each having a different problem of ventilation: full heading, most often used; top heading and bench, close second; pioneer tunnel with cross-cuts; bottom heading; and center heading. The last three are used about equally but far less than either the first or second. Another division of particular interest from the ventilation standpoint divides the work into portal headings and shaft headings.

Ventilation is provided by one or more of the following systems or combinations of them: (a) natural air movements unaided, or assisted by wind catchers at portals, shafts or other openings; (b) plenum method, in which the air in the tunnel is held above atmospheric pressure with escapes via test holes, pioneer tunnel or valved return pipe; (c) high-pressure air in small volume from reciprocating compressors. (In all tunnel work where compressed-air tools are used there is a considerable amount of ventilation and cooling provided by the air discharge by the tools. On the New Cascade tunnel high-pressure compressors furnished 10,450 cu.ft. of free air per minute to tools, in addition to other regular means for ventilation. In some tunnels a fine water spray has been released in the heading after a blast to settle the smoke and dust quickly); (d) low-pressure air in great volume from blowers delivered near the working face by pipe 10 to 24 in. in diameter; (e) withdrawal of air from tunnel by exhausters with resultant fresh-air inflow through pipes to heading; (f) alternating blowing and exhausting by same blowers controlled by opening and closing pipe gates. In some cases the air is exhausted immediately following a round of shots for from three-quarters to one and one-half hours, with the equipment blowing for the remainder of the cycle. Some contractors prefer the exact reverse of this procedure.

Proper Selection of Equipment for Supplying Fresh Air



Operating costs for one year for three types of motors operating at reduced speeds

Design Considerations

In planning for tunnel ventilation there are certain fundamentals to be considered and weighed. These are as follows:

1. State or local laws governing requirements.
2. Determination of maximum requirement at most remote heading.
3. Choice of conductor-pipe size, which will be a compromise between costs of blower set and power on the one hand, and the cost of erected pipe on the other.
4. Selection of type of blowers and motors, considering (a) efficiency, if for long-time use; (b) quietness of operation, if in congested city locations; (c) space occupied by set, if available space is limited.

5. Maximum number of sets that will be in use at one time, considering that some of the sets may be moved from one shaft to another.

6. Desirability for and method of reversing flow of air to and from headings.

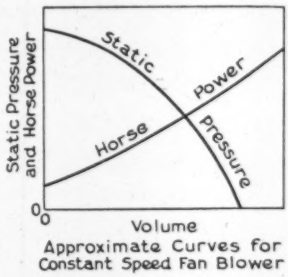
7. Greatest assurance of continuity of service.

The type of motor for the ventilation equipment will be determined by (a) kind of power available, single-phase or polyphase alternating current, or direct current; (b) capacity of power system, which determines amount of starting current available; (c) constant speed or adjustable speed operation; (d) high- or low-speed driven unit.

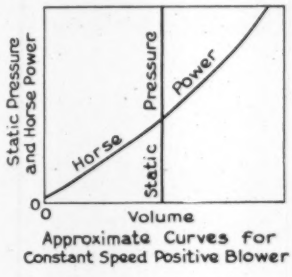
Fans and Blowers

Air is blown in or exhausted from tunnels by three types of equipment: fan blowers, positive displacement blowers and centrifugal compressors. The fan blowers are usually driven by direct-connected motors except for very large sizes, where the low speeds may necessitate a belt or chain drive. The positive displacement blowers are inherently slow-speed units and require very slow-speed motors unless belt or chain drive is used. Blowers of the centrifugal compressor type are inherently high-speed units and are driven by direct-connected motors at 1,750 or 3,500 r.p.m., when a 60-cycle circuit is available.

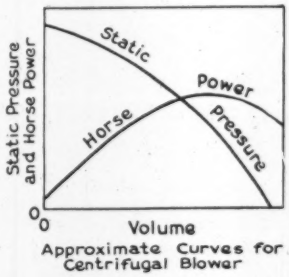
Fan blowers are built with various forms and numbers of blades, which differ somewhat in characteristics. In general, with a constant-speed drive the volume delivered and the horsepower required decrease rapidly as the pressure goes up, because of lengthening the delivery pipe. If sufficient power and volume are available for the longest pipe, the motor is likely to be overloaded early in the construction progress, because of the short pipe and consequently low pressure and high volume. Proper manipulation of gates and vanes will keep the motor load within safe limits.



Approximate Curves for Constant Speed Fan Blower



Approximate Curves for Constant Speed Positive Blower



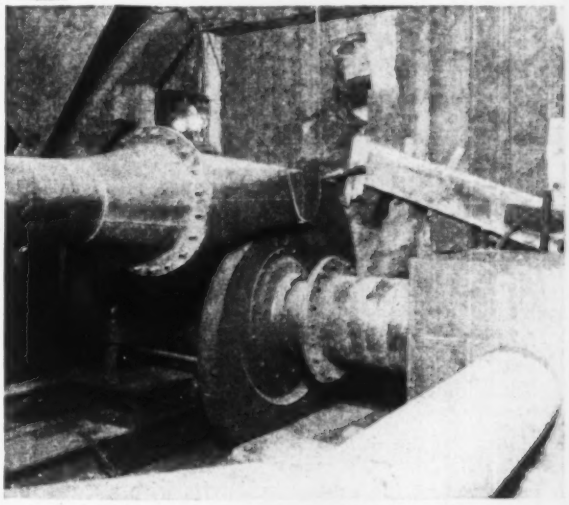
Approximate Curves for Centrifugal Blower

Approximate characteristic curves for three types of blowers

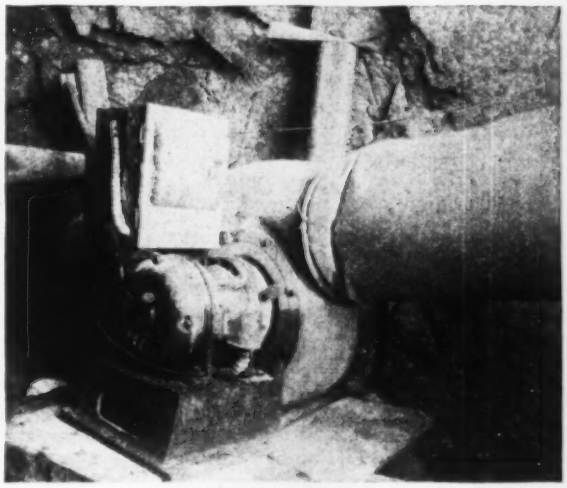
The positive displacement blower delivers, within narrow limits, a constant volume of air per revolution, regardless of speed. With constant-speed drive the volume delivered is nearly constant, and the motor load varies directly with the pressure. If the motor load is large enough to carry the load with the longest pipe, it will be underloaded during the early part of the driving. However, if the pressure is unduly increased by obstructions or by a pipe too long or too small, the motor will be overloaded.

The centrifugal compressor or blower with backward-flow impeller blades establishes a maximum motor load at the normal pressure-volume rating. If the pressure is increased with reduced volume or decreased with increased volume, the motor load falls off. Hence the motor will not be overloaded with short pipe and high volume during the early working, or with long pipe and high pressure toward the time of holing through.

A recent reprint from *Explosives Engineer* yields considerable information on the ventilation methods used in 32 tunnels here and abroad. It is indicated that among those listed: 72.9 miles was ventilated with positive displacement blowers; 32.9 miles was ventilated with fan blowers; 29.2 miles was ventilated with centrifugal blowers; 26.5 miles was not classified.


7,500-cu.ft. centrifugal compressor blower driven by 120-hp. 220-volt induction motor

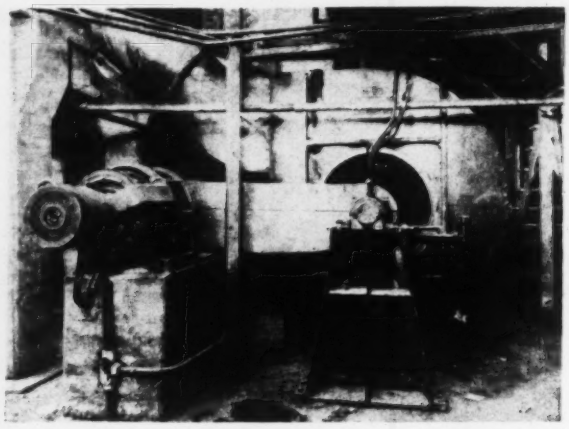
Set is for induced and forced ventilation of New York City water tunnel No. 2.


Portable auxiliary-tunnel ventilating set with 3,600-r.p.m. blower, squirrel-cage motor and full-voltage starter

A description of the ventilation methods used on specific tunnel jobs will serve to show the variety of applications. The Conneaught, Moffat and New Cascade tunnels were constructed with pioneer tunnels. The pioneer system speeded up the work and simplified ventilation. On the Conneaught tunnel ventilation was

effected by blowing air through a 12-in. pipe in the pioneer tunnel, through cross-cuts to the main headings, thence back out to the portal through the main tunnel. Exhausters cleared the headings through a wooden vent pipe after the blast. The Moffat tunnel was ventilated by forcing 8,000 cu.ft. of air per minute at 4 lb. pressure through the pioneer bore, while a 12,000-cu.ft. fan sent air to the heading through a 12-in. pipe. The new Cascade tunnel headings were supplied with 6,000 cu.ft. of air per minute for 27 minutes after a blast; then the flow was reversed for the remainder of the cycle.

The Eureka Crosscut, an access mine tunnel, was ventilated by compressed air blown into the heading from a 2-in. pipe. A 20-in. exhauster withdrew air from the heading through a 12-in. pipe. The Shandakin 18-mile tunnel for New York City water supply was ventilated by positive displacement blowers using the plenum system, aided by high-pressure air after a blast. Operations were carried on from portals and seven shafts with a maximum of twelve headings being worked at one time. The Chicago Ave. tunnel for Chicago's water supply utilized a 6,000-cu.ft. centrifugal compressor for each of the two headings. These blowers were driven by 60-hp. motors to deliver air at 1½ lb. pressure.



Adjustable-speed, 50-hp., 1,260-415 r.p.m., a.c. motor, chain-connected to 90-in. fan blower

Efficiency of fan blower set can be controlled by proper manipulation of gates and vanes.

The New York City water tunnel No. 2, now under construction, is being ventilated by fifteen 7,500-cu.ft. 2½-lb. centrifugal blowers through 14-in. pipe. The longest single stretch of pipe will be ⅞ mile. The blowers are driven by 120-hp. squirrel-cage induction motors. After a blast the sets are operated as exhausters for one hour, then as blowers for the remainder of the cycle. The New York State law calls for 100 cu.ft. of air per man per minute, and as there are about 35 men in each heading the blower at the collar of each shaft must supply at least 7,000 cu.ft. of air per minute. This is enough to replace the air in 18 lin.ft. of full-size tunnel every minute.

Types of Motors

The types of motors and control used will depend upon the starting-load restrictions on the power system. Squirrel-cage induction motors can be used with full-voltage starters if the power system is ample. To modify the starting current inrush, a compensator can be used, as it first applies reduced voltage to the motor with consequent lower starting current. Full-voltage starters or compensators may be of the manual or magnetic types. The magnetic type is most useful for frequent operation, especially if the set is to be started and stopped from a remote point. Since all three of the general types of blowers have no load at start, the current inrush is not likely to be excessive in any case. As another alternative there is available a squirrel-cage type of induction motor derived from the normal design, which is characterized by low starting torque well suited for these loads and has lower than normal starting current.

Where the power line is long and of limited capacity or where the power is derived from a relatively small local power plant, it might be necessary to use a wound-rotor induction motor. The control for this type of motor includes a drum switch, which gradually increases the starting torque, starting current and speed by a series of steps. If the controller handle is moved slowly from point to point, the motor and blower can be brought up to speed with a minimum of voltage disturbance on the power system. Where it is desirable to change the speed of the blower from time to time, this motor may be used, provided the resistor is designed for continuous operation rather than for short-time starting duty. The drawback to operating at reduced speeds with a wound-rotor induction motor is that metered electricity is converted into heat in the resistor, making the operation less and less efficient as the speed is reduced. About 50 per cent speed is the lowest that should be used with this type of induction motor and control.

The brush-shifting type of commutator, a.c. motor, is well adapted for adjustable-speed blower drive, because its efficiency holds up well at reduced speed, which may be as low as one-third of normal. The speed is regulated by shifting the brushes by means of a handwheel or small pilot motor. Where d.c. power is available, the shunt-wound or compound-wound motor having about 10 per cent series field is well adapted for adjustable speed operation.

Squirrel-cage motors are obtainable in two, three or four widely separated speeds, such as 1,800, 1,200, 900 and 450 r.p.m. Efficiencies are good at all these speeds. The speed changes are made by shutting down the set and selecting the desired new speed by means of a pole-changing drum switch. Any of these adjustable-speed motors will economize electric power during the earlier part of operations, but most contractors figure that they can never get too much air; perhaps the quicker turn-around more than makes up for the kilowatts that might be saved by slower speed operation of the blowers.

Reliability of operation is of utmost importance, and the squirrel-cage motor, having the fewest parts, no insulation on the rotor and no moving electrical contacts, will, in the long run, give less trouble than any other type. The control for this type of motor is simple and dependable, especially if full-voltage starting is permissible.

In considering future developments the most striking job in sight is the Hoover Dam project, which will require approximately 16,000 ft. of 50-ft. diameter diversion and spillway tunnels, 3,100 ft. of 30-ft. penstock tunnels and over a mile of 11-ft. penstock tunnels. Several vehicular tunnels are in the offing as well as water-supply tunnels, and it will be interesting to note if any new methods for ventilation are devised or new apparatus made available for this highly essential part of the tunneling art.

Tunnel Equipment—IV

Air-Compressing Equipment and Accessories

Operation and Maintenance of Construction Compressors

By J. F. HUVANE
Manager Compressor Sales, Chicago Pneumatic Tool Co., New York City

FROM THE START of shaft sinking, or portal excavation, to the blowing in place of the last bit of concrete lining, compressed air plays a major role in hard-rock tunneling operations. The machines for producing compressed air have been brought to a degree of efficiency, dependability and durability that is amazing to anyone not familiar with their development. Along with the development of the stationary compressor, the backbone of the tunnel construction plant, remarkable progress has been made in the design of the smaller portable-compressor unit. The portable compressor is rapidly becoming indispensable in nearly every class of construction work. The present status of compressor development is told in this article, in addition to a discussion of the operation and maintenance of various accessories. —EDITOR.

WHILE THE BUILDING of air compressors might well be classed as an old industry, it is still in its adolescent stage. The past decade has witnessed the growth of the portable type of compressor from a crude idea to a well-designed reliable product, found on practically every construction job. Nor has the stationary compressor faltered. On the contrary, it has steadily outgrown its old limitations and has developed into a simpler, more reliable and more economical machine.

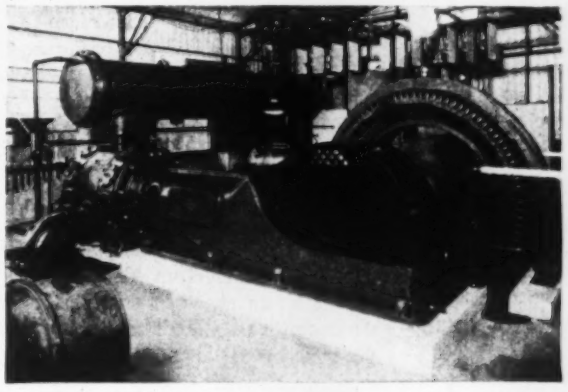
No longer are mechanically operated valves permitted to encumber an otherwise good design, limiting the operating speeds, requiring copious lubrication and consuming plenty of power as they and their noisy driving gear wear themselves to an early end. They have given way completely to the light-weight pressure-actuated plate valve that has made possible quiet efficient operation even at much higher speeds.

Electric Motor Drive

These higher speeds have made feasible the use of direct-connected synchronous motor drive at costs that compare favorably with those of belted units. Formerly the many kinds of electric current available throughout the country made the use of direct-connected motors on construction work quite questionable, especially in sizes up to 200 hp., but the standardization of electric current characteristics by central stations has eliminated this objection, so that contractors invariably specify direct-connected synchronous motor drive even in sizes as small as 100 hp. This drive offers high efficiency, capacity for power-factor correction—usually meriting a more favorable power rate—the elimination of belt losses and troubles, economy of floor space, and a greater salvage value due to the popular demand for direct-connected motor drive, especially for permanent power-plant use.

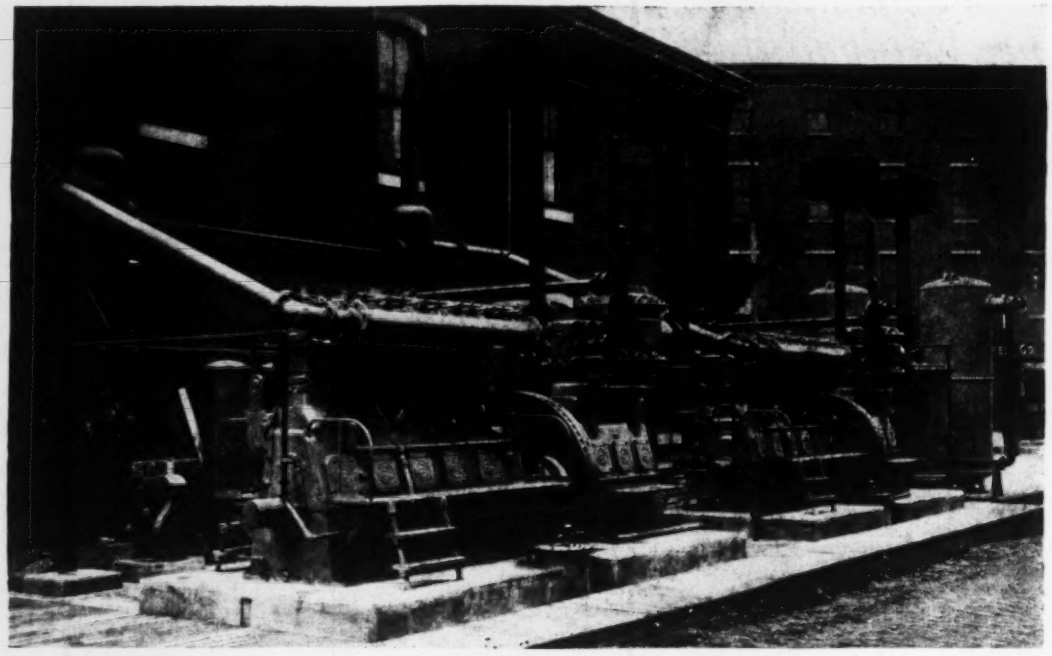
Another development that has encouraged the use of direct-connected synchronous motor drive has been the marked reduction effected in the starting current of such motors, making it possible to employ the across-the-line type of control panel. This panel, operated by a push-button, is considerably cheaper and simpler than the reduced voltage type of panel with auto-transformer and manually operated switches; it has been adopted wherever the local power company's limitations on starting current are not unduly restrictive.

Methods of regulating the capacities of compressors have also steadily improved. The throttling intake unloader, standard with most manufacturers for many years, has almost entirely disappeared. Smaller straight-line machines now employ the so-called "free-air" unloading system, which provides for holding open the inlet valves during the unloaded period; while the same system, or clearance pockets, or a combination of both, is used on the larger duplex machines. The type of regulation to use with the duplex compressors should receive careful consideration, not only because of its value to the contractor but also because of its effect on the salvage value of the machine. While the requirements of the job might be adequately met by the simpler and somewhat less expensive three-step control, the advantages of five-step regulation, especially in permanent industrial installations, have become so generally recognized that it is now usually specified for compressors of 125-hp. size and larger. Multi-step regulation makes possible the operation of the compressor within the most efficient operating range of the motor, and therefore with a minimum power consumption for a given volume of air compressed.



Electric-motor driven two-stage compressor on New York City water tunnel No. 2

For horizontal straight-line compressors in sizes up to 100 hp., short-belt drive is still preferred due to its lower initial cost, simplicity and ease of installation. A noteworthy improvement effected in this drive has been the adoption of roller bearings for the idler attachment, or belt-tightening device, eliminating the troubles previously encountered with the sleeve-type bearings, caused by inadequate grease-cup lubrication. This type of



Two 200-hp. diesel-driven two-stage compressors on Philadelphia subway construction

compressor in the construction field has given place to a large extent to the portable, gasoline-driven type, a transition that the electric power companies have abetted by their failure to provide the contractor with electric service without inordinate delays and at rates that will compete with gasoline as a source of energy.

Diesel Drive

The diesel-engine driven compressor of the stationary type has made rapid strides within the past few years, solving the problems of many contractors who find other forms of power unavailable, except, perhaps, at higher rates. The inherent economy of the diesel engine has been thoroughly established. It is not dissipated in greatly increased carrying charges or greater installation expense or increased cost of attendance, as obviously with a compressor some kind of prime mover must be installed and must have an operator, regardless of the type of drive. A well-designed diesel engine will operate for many years without requiring major repairs and does not require the attendance of an expert operator, experience having shown that any intelligent mechanic can be quickly schooled in the proper care of the engine. Moreover, the difficulty formerly encountered in obtaining fuel oil in small quantities and for quick delivery no longer exists, since such oil is now universally used for firing boilers. Two installations of 240 and 400 hp. total capacities are now helping to build the Philadelphia subway. Another, of 480 hp. total capacity, furnished the compressed air for a section of the Eighth Ave. subway, New York, and yielded savings greatly in excess of the total initial cost of the installation. The economy and reliability of diesel drive have been amply demonstrated on these and many other large construction projects within the past few years.

Compressed air admitted to tunnels must be cooled to condition it for human consumption. It is advisable to cool the air on practically all compressor installations in order to remove excess moisture that otherwise is carried by the air into rock drills or other machines. The moisture tends to wash away lubricants, causing excessive wear and increased air consumption. In some air tools operation is seriously retarded by the freezing of moisture in the air at the exhaust of the tool. This trouble can be entirely avoided by the use of an aftercooler, which, by cooling the hot compressed air, condenses and deposits the moisture so that it can be drained off instead of entering the air lines. The use of such aftercoolers has gained marked impetus within the past few years due to improvements in design which have more than doubled their air-handling capacity per square foot of cooling surface. Sharp reductions have been made in their size, weight and cost, while their cooling-water requirements have also been greatly diminished.

The aftercooler should be located between the compressor and the air receiver and preferably indoors to guard against freezing of the water. Aftercoolers and air receivers should be drained at least once a day, yet this simple and obvious function is frequently neglected until the condensed moisture is carried into the air lines, thus defeating the very object of an aftercooler.

Another boon to the compressor user has been the development of the air filter. This device is placed in the compressor intake line and by keeping dirt and grit out of the cylinders and valves greatly prolongs the life of these parts and lessens the amount of attention which they require. All air compressors should be equipped with an efficient filter but particularly when used on construction work, where the atmosphere is usually heavily laden with rock dust and other abrasives. Air filters are quite inexpensive and require little but regular attention.

Correct Lubrication Important

The old admonition against the use of unsuitable and excessive lubricating oil in air-compressor cylinders is still pertinent and cannot be repeated too often. There is no longer any excuse for poor oil, as all reputable oil companies have developed suitable lubricants for this service and are always eager to investigate any lubrica-

tion troubles that are called to their attention. Most troubles result from using too much oil. Therefore, the accompanying table, taken from the Compressed Air Society's trade standards and showing approximately the amount of oil required for proper lubrication of an air cylinder, may be of interest.

OIL REQUIRED FOR CORRECT LUBRICATION OF AIR CYLINDER

Cylinder Diameter, In.	Piston Displacement, Cu.Ft. Per Min.	Rubbing Surface, Sq.Ft.	Oil Feed—Drops Per Min.	Oil Feed—Pints Per 10 Hours
Up to 6	Up to 65	Up to 500	1	05
6 to 8	65– 125	500– 750	1	08
8 to 10	125– 225	750–1,100	1	11
10 to 12	225– 350	1,100–1,500	1– 2	14
12 to 15	350– 600	1,500–2,000	2– 3	20
15 to 18	600–1,000	2,000–2,600	3– 4	27
18 to 24	1,000–1,800	2,600–3,600	4– 5	36
24 to 30	1,800–3,000	3,600–4,800	5– 6	48
30 to 36	3,000–4,500	4,800–6,000	6– 8	60
36 to 42	4,500–6,500	6,000–7,500	8–10	74
42 to 48	6,500–9,000	7,500–9,000	10–12	90

The above figures are for one cylinder only. For duplex and compound machines both cylinders must be considered.

Portable Units

Introduced to meet a limited demand, the portable gasoline-engine driven compressor has created a new and broader field for itself, having made possible the use of compressed air in places where the stationary type could never be used, and consequently encouraging the development of many air-operated labor-saving devices. To some extent it has replaced the smaller sizes of stationary compressors for construction work, the speed and economy of setting it to work frequently offsetting the advantages of cheaper power and the greater simplicity of the stationary type. In addition, the portable machine obviates the necessity for long pipe lines. It is not uncommon to see a battery of portable compressors supplying the air for a large project before the stationary plant can be set up, making possible a quick start and saving valuable time. The portable compressor has been developed into a simple reliable unit, but, as with all other classes of machinery, the character of the service it renders depends upon the character of the attendance it receives.

Tunnel Equipment—V

Progress in Tunnel Mucking and Haulage

Muck-Handling Equipment in Modern Tunneling Practice

By DANIEL J. O'ROURKE
Sullivan Machinery Co., Chicago, Ill.

EXCEPT in poor ground requiring elaborate time-consuming timbering, the operation of getting the muck away from the face of the heading and out of the tunnel is the limiting element in tunnel-driving progress. Mechanical mucking first replaced the laborious hand methods on large-bore tunnels, spreading, as suitable machines were developed, to smaller and smaller sizes, until today it is a rare project that does not utilize some form of mucking machine. Cutting down the old reliable steam shovel and operating it by air produced the early mechanical mucker. This type machine is still finding favor in many tunnels. Other types were introduced, some operating on a shovel principle and others on the idea of a conveyor. Now a different type of machine, the power scraper, is being adopted for tunnel mucking. The author, thoroughly familiar with the development of the scraper loader, has devoted much of this article to a discussion of its origin and use. —EDITOR.

SPEED AND ECONOMY in driving rock tunnels depend on a combination of many factors, including drilling, mucking, haulage, ventilation, timbering, drainage and, most important, organization and management. When five rounds per 24 hours are drilled, shot, and mucked out, as was done on the Cascade tunnel of the Great Northern Railroad, it can be seen that organization is indeed a basic factor. Mucking and haulage have a place of prime importance in planning for tunnel speed and low cost. Very often they are the governing factors, since with the development of the newer high-speed drifting drills and the use of tunnel carriages and other aids to time-saving in set-up the drilling crews will be kept waiting unless the mucking job is properly organized.

Haulage methods and equipment have been well established. Excepting improvements in type or detail, there are no important new developments in this class of equipment. The electric-trolley locomotive, the electric storage-battery locomotive and the gasoline locomotive are all well known and efficient; the type and size selected in each case depends on limiting conditions, such as the size of tunnel and length of haul. In many cases the old four-legged standby, the mine mule, still finds work to do.

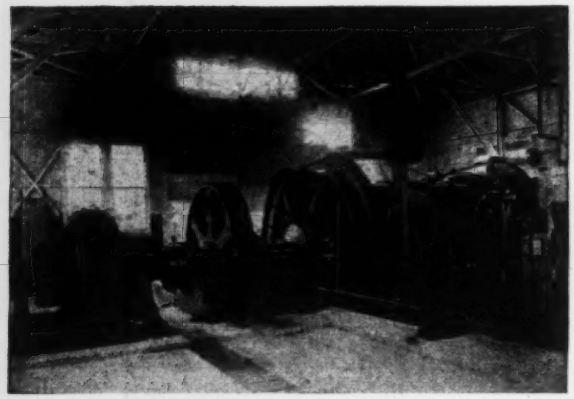
While the size and type of muck cars are determined by individual job conditions, there has been a marked trend toward the dependable all-steel dumping car. The almost universal adoption of mechanical mucking machines has necessitated the development of a durable long-life car, heavy enough to stand up under rapid loading.

Hoisting equipment is also subject to individual shaft conditions. There has been a steady improvement in tunnel hoists as to speed and safety. Dependable mine hoists are finding a place on tunnel projects. An accompanying illustration shows the type of mine hoist being used on nineteen shafts of New York's second water tunnel, now under construction.

Types of track and weight of rail are dependent upon muck-hauling and concreting layouts. The portable track unit, built up in sections with steel ties, is replacing loose rails and wood ties in many projects. Built-up sections now include switch layouts.

Mechanical Car Switching

For car service in tunnels that are too small to carry two tracks close up to the face a pneumatic or mechanical car switcher has been used successfully in a number of tunnels. One of these, developed by the author, is a compressed-air hoist, consisting of an operating cylinder suspended from a two-wheel trolley run-



Type of mine hoist in use on New York City water tunnel No. 2

Steam shovel converted to air-operated mucking machine

ning on a 4-in. steel bar. The bar is supported by shackle bolts hanging on drill rods driven into the tunnel walls. To the piston rod of the cylinder is attached a beam carrying a hanger at each end, which hooks to the car frame. Operating valves are placed conveniently in the air line. The switcher is set back of the loading machine at a distance approximately the length of a haulage train. An empty car is lifted bodily from the rails and placed to one side. The train then moves forward to the loading machine, and the first car is loaded. As the train backs down, the empty car from the side is hoisted back onto the main line in front of the loaded car. The train moves forward again to load, and another empty car from the rear end of the train is then hoisted to the side track while the front car is being loaded. This cycle is repeated until the whole train is loaded.

Getting the muck into the cars and getting the cars away from the face are operations affording opportunities for increasing speed and lowering costs. While there are many tunnels (particularly the shorter ones) that are still being mucked out with hand shovels off of steel plates, and the loaded cars pushed by hand back to the waiting mule or locomotive, the large majority of tunnel projects depend upon the employment of mechanical methods for successful progress.

For many years the dream of inventors has been a machine that drills the tunnel face and loads the blasted muck into cars behind it, permitting a continuous cycle of operation with minimum human labor. Unfortunately, most of these ideas have remained in the dream stage, and those that have emerged have rarely proven practicable or had a long life. Tunnel engineers now separate the drilling and mucking operations and are spending their efforts on developing mechanical mucking equipment to keep up with the drills. An analysis of the haulage problem, however, quickly determines the number of locomotives and cars necessary to dispose of any given volume of muck in a given time.

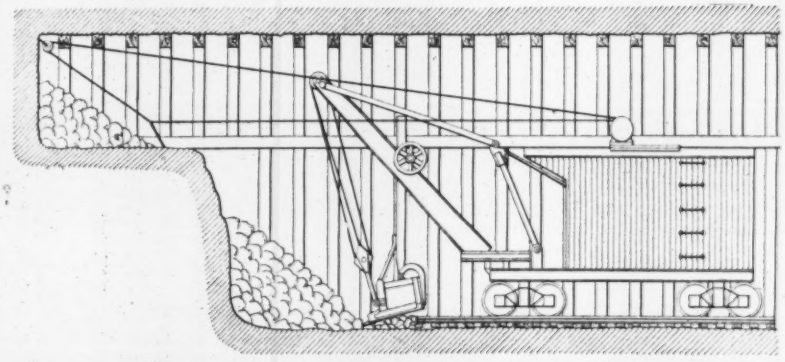
Various Mucking Machines

The use of large air-operated shovels underground is familiar to experienced tunnel men and engineers and needs no elaboration. Their use is of necessity confined to tunnels of considerable dimensions in which there is sufficient space for swinging the boom and loading cars drawn up alongside or behind the shovel.

There is another group of smaller compressed-air shovels which also render excellent service. Some of these swing to the side, and in one or two instances the shovel throws its load back over the machine into the waiting car. Still a third type of mucking machine is of the conveyor pattern with a digging member or apron and arms that pull the muck onto the main conveyor, which in turn delivers it to a tail conveyor and to the cars. The advantage of this type of loader is that it can operate in smaller tunnels, as only one track for cars is required at the face. This type of mucker is operated either by air or electric drive. Accompanying illustrations show these various types of machines.

Selection of the most economical type of machine for mucking out tunnels of any size, except when it is definitely known that no timber support will be necessary, is a matter for careful consideration.

There is nothing particularly difficult in driving a tunnel in good rock that requires no timbering, and few of this kind are encountered—a matter more of luck than geology. When the necessity for timbering arises in tunnel construction the time in which the roof can be supported is an important item; and the job is not completed until the roof timbers are supported to grade by plumb posts.



Combination scraper and shovel mucking, Cascade tunnel

Scraper, operated by hoist on top of shovel, pulls muck from heading within reach of shovel

Electric-operated mucking machine, conveyor type

Shovel-type small mucking machine, air-operated

Where individual timber sets are specified the problem of getting in the plumb posts is a little more complicated than when a wall plate is used, as they have to be placed first and the segments built on them. In either case it is necessary to get the plumb posts as close to the face as possible after it has been drilled and blasted, and the face of the tunnel is the last place that can be mucked out by any of the equipment mentioned so far; thus considerable hand-mucking is necessary.

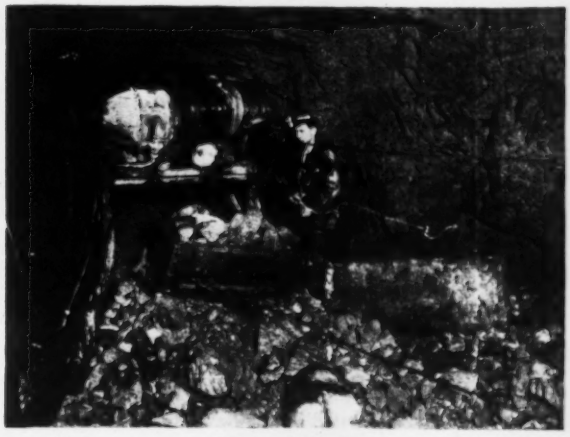
Scraper-Type Loader

For some years the mining industry has been using a scraper mucking machine which, in all cases, has succeeded in reducing loading costs. This type of machine which is now being used successfully on tunnels up to and including sizes common to single-track railroad tunnels, represents one of the oldest mucking ideas, and in its evolution has acquired the title of scraper loader.

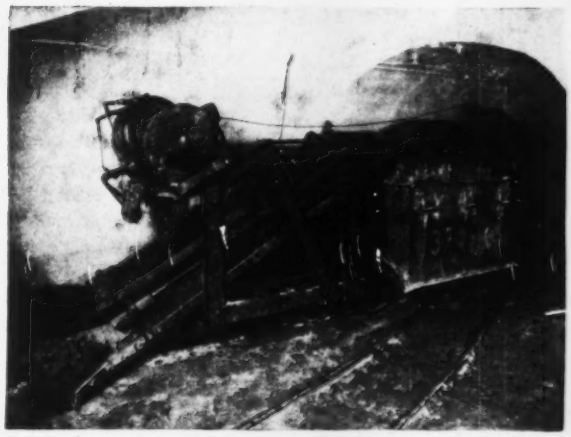
The loader consists of a structural-steel frame on which a double-drum hoist is mounted. One drum handles the pull rope, and the other the tail rope for pulling a scraper, properly designed for the class of material to be loaded, back and forth from the muck pile up a slide or incline to the top rear end of the frame, where the muck drops through an open trap into the cars underneath. The entire framework of the machine is made of structural steel, mounted on four wheels or trucks so that it can be moved back and forth in the tunnel on the regular tunnel track. When working, the machine is clamped to the rail. In some instances the slides are made with hinged aprons and side wings or flanges, which fold up when the slide is being transported.

In addition to the slide and the hoist itself, which ranges in size from two-drum compressed-air or electric units of 6½ hp. up to large double-drum electric hoists of 50, 75 or in some cases as high as 150 hp.; the equipment consists of a scraper (usually of the hoe-box type), pulling rope, snatch blocks or sheaves, and some means for securing the snatch block at the face.

The slides are ordinarily made up on the ground or in a local shop. In ordinary operation, using the portable slide, one car at a time is loaded. In the larger or semi-stationary slides several cars may be loaded at once.



Scraper-type mucking machine handling large rock
Air or electric motors can be used with these rigs.



Modern Osana-type scraper mucking machine
Equipped with 25-hp. electric motor and hinged-front apron plate.

Practice as to choice between the two types of loading slides is still very much in process of experiment, but generally it may be said that experience thus far indicates the use of a portable slide in tunnels smaller than 12x12 ft. in section; while in tunnels larger than this the semi-portable slide seems to be the more popular. While the smaller portable slide can be moved up to within 10 or 12 ft. of the muck pile at the conclusion of blasting on each round, making the maximum distance to be scraped 30 to 50 ft., the larger semi-portable slides are usually moved up about once a week. This makes hauls up to 150 or even 175 ft. usual at the conclusion of the period and indicates the use of larger scrapers.

The sizes of scraper employed vary with the power of the hoist, the length of haul and the size of cars to be loaded. Frequently the tail sheave is attached to a hook wedged into holes driven in the face or on the rib. It is frequent practice to have three hooks across the face and to shift the tail block from one to the other, in order to get the maximum service from the scraper. After the cut is loaded out it requires only a few minutes to pull the scraper and tail block up on the incline, loosen the rail clamp, disconnect the power cable, raise the front apron and pull the machine away from the face.

Aside from its economy of operation, the machine has the advantage of not being limited as to where it begins mucking. It can remove the muck from either side of the tunnel up close to the face of the bench or heading so that timbering can be started. When both sides are mucked out and full timbering operations are in progress the muck left in the center of the tunnel can be removed without interfering with the timber crews.

The speed of mucking out between drilling rounds is amply sufficient, when properly organized with car service, to maintain a rate of progress for 24 hours required in any given case. The slide is adaptable to any size or any height of car required by the conditions. Electric or compressed-air hoists of suitable sizes and scrapers of proper width and shape can be provided to handle the character of muck encountered, the tonnage to be handled and the speed required.

As an example of the adaptability of the scraper-mucking method to varying conditions, the accompanying drawing is interesting. It shows a 6½-hp double-drum hoist of the compressed-air type, mounted on top of a shovel in the Cascade tunnel. A tail block attached to the top of the face in the top or pilot heading made possible the scraping off of muck in this heading and dropping it onto the floor of the main heading within reach of the shovel dipper. In this way the heading was driven in advance of the enlargement, the maximum distance being about 40 ft. The mucking time was reduced to one-third or one-fifth of that which would have been consumed if the heading had been mucked out by hand.

Tunnel Equipment—VI

Evolution of the Concrete Lining Plant

Changes Since the Days of Crude Mixers, Hand Placing and Wood Forms

By J. H. FITZGERALD
Fitzgerald & Hudson, Equipment Distributors, New York City

THE DEVELOPMENT of present-day concrete-tunnel lining methods and equipment has taken place in the comparatively short span of a decade and a half. Pneumatic placing machines could not be brought to a satisfactory degree of performance until the mixing of concrete could be definitely controlled and the product made uniform. With perfection of the placing machine came the development of the sectional steel-tunnel form—collapsible, easily stripped, moved and reset. The combination of the steel form and pneumatic concrete-placing rig is responsible for rapid lining methods found in modern tunnel practice. This article outlines the development of lining equipment. —EDITOR.

TO REALIZE the advance and improvements in lining tunnels with concrete, a comparison of the general methods used in pre-war times with those of today is necessary. The three elements of the tunnel-lining plant—the mixer, the conveying and placing equipment, and the form—have been the subject of remarkable changes during the past fifteen years.

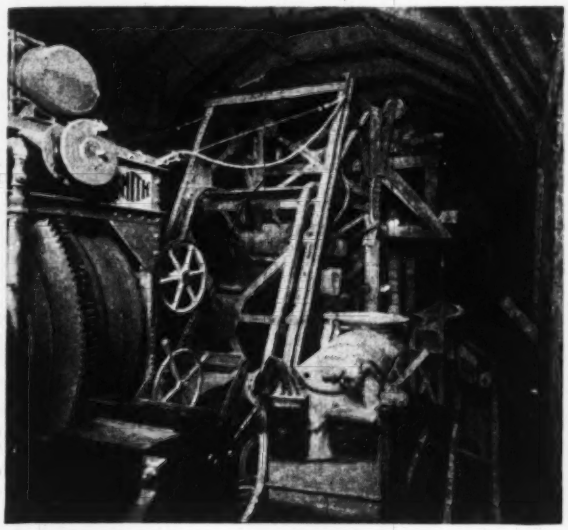
Concrete Plants

In the past it was the usual practice to locate and lay out the concrete plant in the early stages of the job because of the size and space requirements of the huge cumbersome wood storage bin. This was built of 12x12-in. posts and 3x12-in. braces, with a laminated flat bottom of 3x12-in. timbers. Heavy partition walls divided the bins to allow about two-fifths of capacity for sand and the balance for stone. Square vertical wood chutes wtih metal cutoff gates carried the material through the two openings left in the floor, usually 24x24 in., to the batch hopper on the concrete mixer.

Sand and then stone were permitted to fill the hopper up to lines painted by the inspector, and the charge was completed by dumping in the required number of sacks of cement. Later, as a start towards more accurate proportioning, the batch hoppers on mixers were furnished with division plates providing one side for stone and the other for sand. In a few rare cases these are still in use.

The modern all-steel bin, light, portable, easily erected and available in any desired capacity, supplanted the wood structure. Measuring batchers of steel with fast cutoff gates, equipped with various types of quick adjustment for any desired amount, replaced the batch hopper for measuring purposes; but the demand for more exact proportioning continued until the weighing batchers were finally perfected. These devices are extremely accurate, weighing the sand, stone and cement on separate beams.

Water, a neglected item when ankle-deep was the regular slump test, was formerly measured by three methods:



Complete underground plant for lining tunnel

Pneumatic placing machine in lower center. Chute at right is for pouring direct into low wall forms. Entire plant on carriage, permitting passage of muck trains underneath.

by guess, by barrel and by tank. The amount of water was gaged in the barrel by overflow holes drilled in the side, of which all but one were plugged. In the first mechanical tanks adjustable discharge pipes or hose within the tank were used to obtain constant quantities of water per batch. Open top tanks with gage glasses were tried next but were soon abandoned because they accumulated ice, dirt and leaves.

The present-day spiral cutoff tank is absolutely accurate and will not vary in discharge once the regulator is set. It is controlled by two vertical pipes, one closely fitting within the other. The outer pipe, which is stationary, has a spiral slot from top to bottom; while the inner pipe, with a vertical slot its full length, revolves with the regulator dial. By setting the regulator dial the point at which the two slots coincide can be set at any desired height in the tank, thus breaking a syphon in the discharging of the tank to control the amount of water per batch. The control device also carries a compensating regulator to allow for amount of moisture in the aggregate.

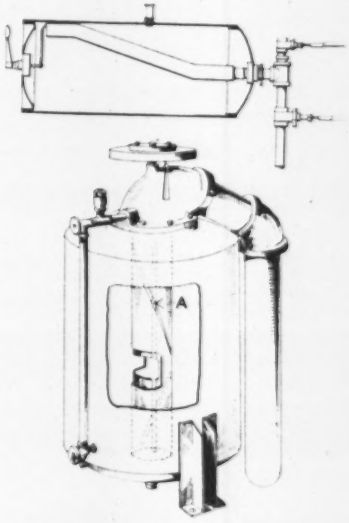
Mixers Improved

The pre-war mixers were mostly steam operated, mounted on wood frames, with cast-iron gears and traction rings, babbitted bearings and cold-drawn steel shafts. Replacing the wood with all-steel frames was the next improvement, and machine-molded gears were introduced. Today we have accurately cut steel gears running smoothly and quietly in a bath of oil. Babbitted bearings gave way first to machined removable bronze bushings and finally to roller and ball bearings. The crude cold-drawn shafting has been entirely eliminated by high-grade alloy steel, as also have the old cast-iron traction rings. Multiple-cylinder automotive-type gasoline engines and electric motors have supplanted the steam engine, resulting in compact, sturdy, foolproof and dependable concrete mixers.

Another up-to-the-minute refinement, almost standard equipment on large-size mixers, is the power discharge that permits remote control from any point on the operating platform. The batch meter for timing the mix in the drum is an attachment that effectively locks the discharge chute until the required time for mixing has elapsed, when a bell rings and the concrete may be discharged. Every batch is uniformly timed, and a record of the number is shown on an automatic counter.

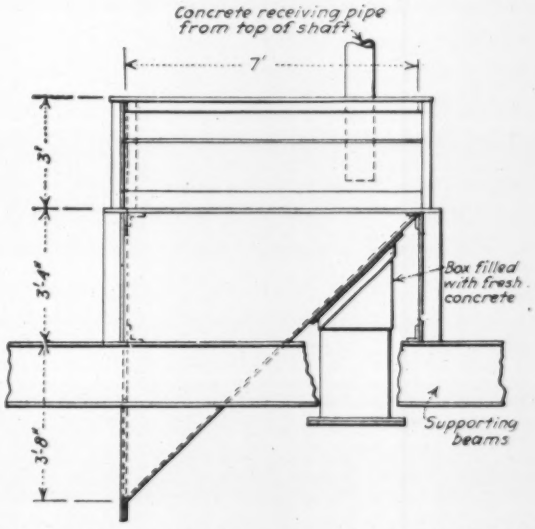
Transporting the concrete to the tunnel was a slow procedure. Cars of 1-cu.yd. capacity were loaded at the mixing plant and moved to the cage or shaft elevator by man-power, mule or locomotive, and lowered one at a time to the tunnel, where the car was held until the required number to make up a train-load was ready. Then the train was moved to the point of placing.

Today the plant is usually located right at the shaft, with the mixer discharging directly into a hopper, which in turn feeds the concrete into a vertical 6-in. steel pipe to a hopper in the tunnel. Baffles have been tried to break the force of the falling concrete, but they wore out so rapidly that their use was discontinued. The problem of providing a durable receiving hopper proved to be a difficult one. Railroad rails were tried in the floor, then manganese crusher jaws were used to resist the abrasion of falling concrete, but neither lasted long enough to warrant their adoption. Fresh-mixed concrete was found to be the most suitable material for a receiving mat. Special hoppers were constructed with an opening directly under the end of the vertical conveying pipe. To the opening a heavy metal box or pipe with a reinforced gate was attached.



Old (above) and modern water tanks for mixers

Inner pipe sleeve with vertical slot can be turned to place point of coincidence *A* with spiral slot in outer pipe at any elevation to control amount of water per batch.

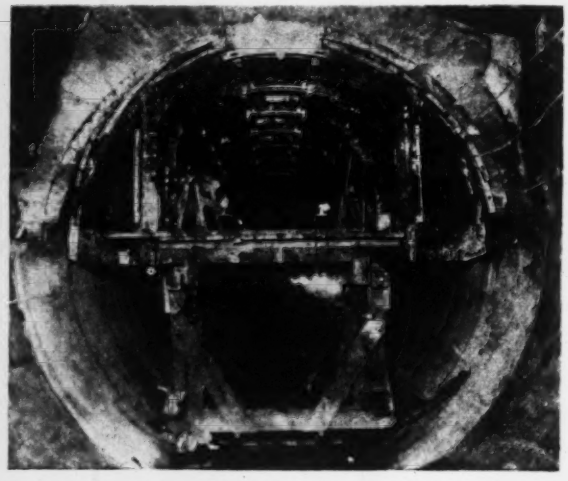


Special hopper to provide concrete cushion to break fall of concrete down a shaft

This box, filled with fresh concrete, cushioned the fall of succeeding batches which overflowed into the main hopper.

Forms

In the pre-war period the concrete lining was almost invariably placed in three separate operations, the invert, the side walls and then the arch. In placing the invert the tunnel track was raised to heavy cross-struts resting on the tunnel wall high enough to clear the invert forms. The forms usually consisted of 3x12-in. planks supported by adjustable 1-in. rods, with a pipe spreader holding them in pairs, the top edge of the planks set flush with the finished concrete line. From 500 to 1,000 ft. of form was set up at a time. The concrete in cars was pushed out on the track and dumped directly between the forms, after which a screed board of the required radius was used to produce the correct curvature. Recently an all-steel invert form has made its appearance. This form produces a finished invert 8 ft. wide in a 17-ft. diameter tunnel. It comes in 200-ft. sections, and the track or high line is part of the unit.



Early steel tunnel arch forms on wood carriage

After the invert had been placed the carpenters immediately began setting up 20 to 50 ft. of side-wall form. The side-wall forms usually consisted of 1-in. sheeting on 2x8-in. segmental ribs, made up in panels. The panels were held in place by removable braces.

A heavy timber incline trestle permitted the concrete cars to be hauled up to the top level of the side forms, and the concrete was shoveled into the forms by hand. The arch forms were of similar construction, but the labor of moving these was so great that wood wheels with rims shaped to fit the radius of the invert were tried out. While the improvemet was perceptible, it left much to be desired. The timber used in the arch required so much space that, in many cases, the cars could not be dumped.

Experiments were being tried out with steel forms about this time. One type consisted of side wall with ribs on 5-ft. centers. These ribs were split and keyed at the bottom so as to be collapsible. A single plate on each side bent to the correct radius was bolted to the outerside of the ribs. The arch forms consisted of a series of steel ribs on 5-ft. centers to which loose plates were fastened, additional plates being added as the concrete was placed. These forms were made collapsible by arranging the sides to swing inward on a hinged joint near the top of the ribs. The entire form was mounted on a timber carriage equipped with wheels.

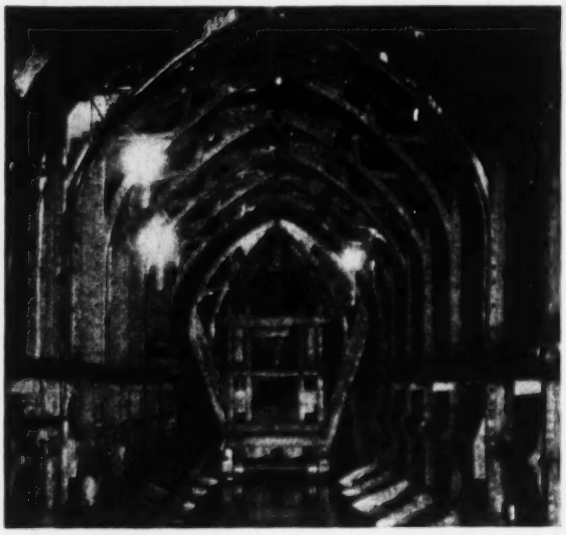
The present tunnel forms are all steel, including the carriage. The ribs are rapidly collapsed with turnbuckles or similar contrivances and lowered clear of the roof by jacks. Attached to these forms and mounted on wheels is the steel incline and gun carriage which moves as a single unit.

Pneumatic Placing

In the early development of means of placing concrete behind the form by compressed air the process was tried out on several tunnel jobs, but after a short trial it was temporarily abandoned because of constant blocking of the pipe line. The machines were so large that it was impossible to locate them in a favorable position, and the tunnels selected for the experiment were too small to permit proper charging of the machines.

Experiments with air placing were carried on in the open and on New York subway work. In the meantime, a placing machine was constructed that was purely mechanical in operation, being similar to the erector used for placing cast-iron linings in shield tunnels. The erector arm was designed to pick up a bucket of concrete and empty it behind the forms. This idea was soon abandoned because of many objections; the buckets would not dump clean, and the limited clearances in places between the rock line and the tunnel form left insufficient room for the proper manipulation of the bucket.

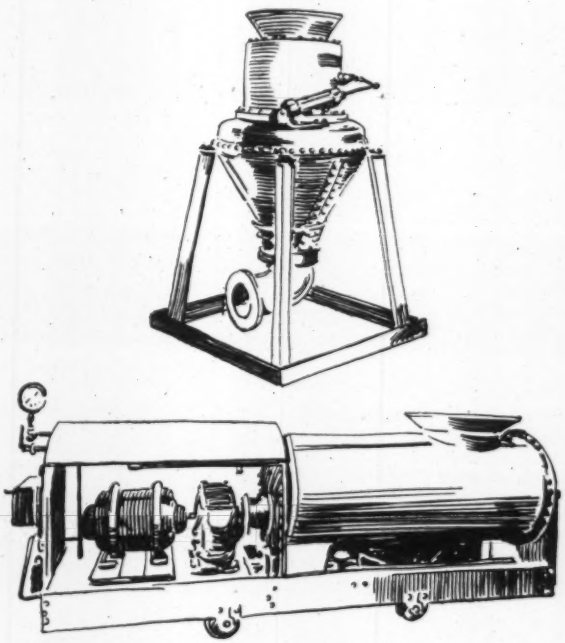
About the time of the failure of the bucket type of placing machine a vertical pneumatic tank was developed which would place concrete through a 6 or 8-in. pipe in a satisfactory manner. This tank required a charging height of 8 ft. Many so-called improvements added to this machine failed to work out in practice.



Modern steel tunnel forms on steel carriage

Section in background is collapsed, ready to move forward to new set-up through forms in place in foreground.

The next improvement in pneumatic placing machines was the horizontal type, designed to be placed and loaded in the tunnel. This type of concrete gun is found on almost every tunnel job today. There are three general types of pneumatic machines in modern use. One of these types is a cylinder with an opening on top for charging, the discharge end of the cylinder tapering



Above, old-type vertical pneumatic concrete placer, charging height 8 ft. Below, one of latest horizontal-type placers, 3½ ft. high, mounted on wheels

down to a 6-in. pipe connection. After loading, a ram of the same diameter as the inside of the tank is forced forward by compressed air, pushing the concrete ahead of it. When the ram has passed the door opening, effectively sealing the forward chamber, air is applied at a point a short distance back of the discharge end of the machine and the concrete forced out. The ram is forced back of the door opening and the cycle repeated.

Another horizontal placer of the cylinder type has a charging door in the top for loading and a series of pipes or jets along the inside floor of the tank. These pipes vary in length and keep the concrete feeding toward the discharge line.

One of the latest improvements in pneumatic concrete-placing machines is the horizontal type mounted on wheels or on the side of the steel-form carriage. This machine has a flat charging door, which is pulled back along slides located on the top inside the tank, and operated by a compressed-air piston. When the concrete is in the chamber the door is closed and the air is opened into the discharge line, creating a temporary vacuum in the tank. A spiral conveyor, extending the full length inside the chamber and operated by air or electric motor, is started, and the concrete is forced into the opening over the discharge line. From here it is carried by air to the form through the discharge pipe. The advantage claimed for the worm or spiral is that the speed at which it feeds is set so as to get the maximum output without feeding into the discharge line more concrete than the air can take away, thus avoiding blocking the line. The worm conveyor also overcomes the inertia of the load of concrete, thus decreasing the amount of compressed air required to start the batch in motion. It is a compact machine, 3 ft. high, 2½ ft. wide and from 8 to 10 ft. long.

A modern concrete lining plant might consist of the following equipment: a two-compartment steel bin with cement hopper and a three-beam weigh batcher, the stone and sand placed in the bin by derrick, bucket elevators or crane, and the cement stored in an adjacent steel bin and carried to the auxiliary hopper by screw conveyor. For loading the cement-storage bin either the pneumatic method using air or the inclosed bucket-elevator method is used. The mixer is set beneath the bin with the receiving hopper directly under the weigh batchers and is operated entirely from the working platform above it. When the concrete is discharged it goes into a funnel-shaped hopper and thence into a vertical 6-in. pipe, dropping by gravity to the foot of the shaft into a receiving hopper. Concrete cars are loaded and pushed by locomotive to the foot of a steel incline or trestle, where they are disconnected and a cable is attached. A small hoist located on the far end of the form pulls the cars up the incline onto the gun carriage, where it is dumped either directly into the placer or into a receiving hopper over the placer. From this point it is shot to the form through a 6-in. pipe or special 6-in. hose furnished with built-in steel nipples.

Another tunnel concrete-plant layout used on modern projects has the mixer placed within the tunnel, adjacent to the form. The mixer dumps directly into the receiving hopper of the pneumatic placing machine. In this layout aggregates are usually batched in a surface plant and dropped down the shaft to the tunnel in correctly proportioned batches. Single or double-batch cars convey the aggregates to the mixer. The mixer and concrete gun are mounted on a carriage. In the Cascade tunnel this carriage was designed to permit the passage of muck trains beneath, without interference to either mucking or concreting operations.

Two methods used in placing concrete lining in same tunnel

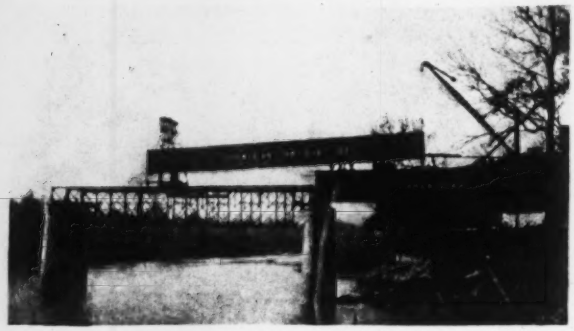
Left: chuting sidewall lining from dump car.
Right: steel forms and pneumatic gun used for arch.

FROM JOB AND OFFICE

Hints That Cut Cost and Time for the Contractor and Engineer

Mobile Gantry Used to Erect 120-Ft. Bridge Girders

CONSTRUCTION of a new bridge for the Missouri Pacific Railroad, in connection with its new Meramec River cutoff in St. Louis County, Mo., involved the erection of 88 plate girders varying from 50 to 120 ft. long. The shorter girders were placed in the usual way with a



Gantry moving 120-ft. girder into position

derrick car, but the ten 120-ft. girders required special equipment. A scheme of erection was devised in which the front end of the girder was rolled into position by a traveling gantry frame carried on light-truss falsework.

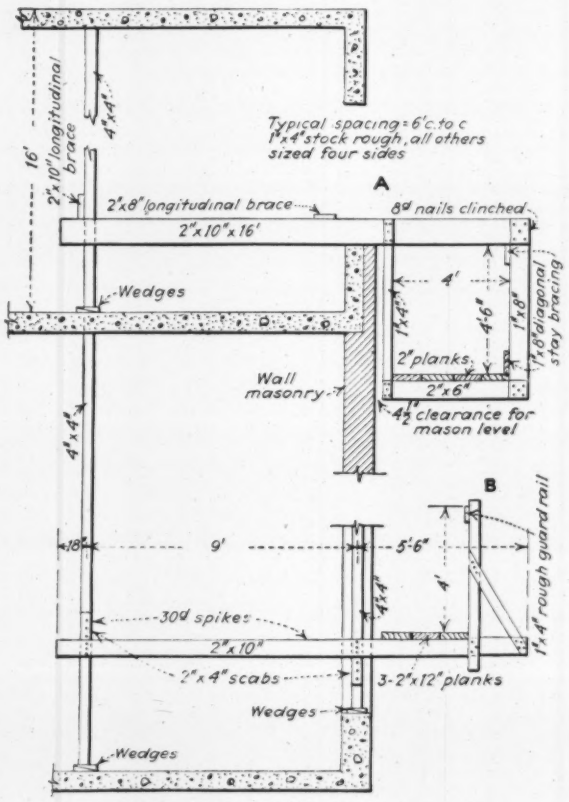
The derrick car boom with a reach of approximately 60 ft. was able to set the two falsework trusses in place from a position at the end of the last completed span. The gantry crane was also lifted into position on the top chords of the falsework trusses by the derrick car. The girders were rolled on trucks up to a point on the bridge where one end of the girder could enter the gantry. With the gantry carrying one end and the derrick car the other, the girder was run out and lowered onto its shoes, which had been previously placed. The derrick car then moved the falsework trusses forward, and the next span was erected in a similar manner. The erection work was done by the Kansas City Bridge Co.

Scaffolds for Building Construction

By J. D. LEVIN
Construction Engineer, Milwaukee, Wis.

MASONRY work in building construction requires outside scaffolds for the men. The accompanying drawing shows two types of light outrigger scaffolds that have been used successfully by the writer on building projects that he has superintended. In the drawing, the upper portion, *A*, shows a light "lookout" scaffold which can be cheaply and easily made from lumber available on the job. Such a scaffold consists of "lookout" units, as they are called, made by nailing two 1x4-in. rough vertical supports to a 2x10-in. outrigger, with five 8-penny nails clinched, and in the same manner nailing a 2x6-in. ledger to the lower ends of the vertical members. These units are spaced about 6 ft. c. to c., as shown, leaving sufficient clearance from the farthest masonry projection so that the mason can line up his work without interference from the scaffold. The outriggers or "lookouts" are well braced against overturning and slipping by nailing them against 4x4-in. shores wedged between floor and ceiling. Additional safety and rigidity are obtained by using the continuous 2x8-in. and 2x10-in. longitudinal braces.

Such a scaffold may be used for a maximum safe uniform load of 30 lb. per sq.ft., or 120 lb. per running foot of scaffold, if the outriggers are spaced 6 ft. c. to c. For wider spacing the safe load is reduced proportionately. The scaffold employed for setting the quoin stones is of similar construction, except that the vertical supports are considerably longer. In all cases, however, the scaffold is intended only to carry masons and mortar boards, the brick and stone being piled within reach on the structure proper. One experienced scaffold carpenter and a handy laborer as assistant sufficed to make, erect and move scaffolding for a crew of twenty masons. By substituting 2x6-in. vertical members for the 1-in. stock, and using four 20-penny nails instead of the five 8-penny nails, with the outriggers spaced 6 ft. apart and properly braced, such a scaffold may be safely used to carry a maximum uniform load of 50 lb. per sq.ft., or 200 lb. per running foot.



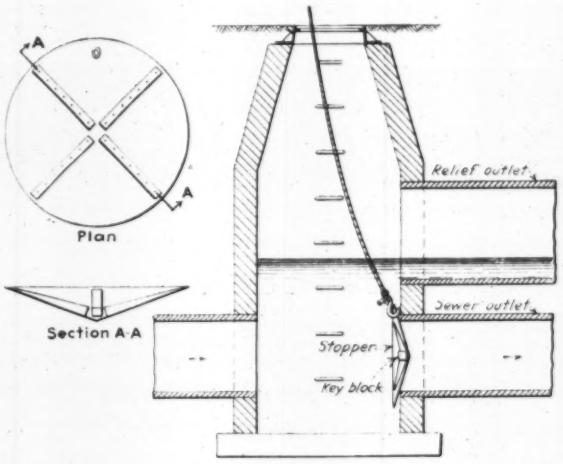
Two types of building scaffolds

A type of scaffold employed for cement finishers on a large Chicago building job is shown at *B*, in the lower part of the drawing. Essentially it is like the scaffold mentioned before, except that instead of being carried partly by an upturned beam, it is spiked to a 4x4-in. post wedged between the spandrel beams. The outriggers are spaced the same distance apart and are nailed to the supporting shores with three 30-penny spikes, additional strength being obtained by using 2x4-in. cleats nailed in a similar manner and in such position as to resist the overturning moment of the scaffold. A 4-ft. guard rail, made of 1x4-in. rough stock, provides protection for those working on the scaffold. Such a 3-ft. scaffold will sustain a maximum safe uniform load of 50 lb. per sq.ft., or 150 lb. per running foot of scaffold.

Collapsible Stopper Diverts Sewage

By TRUMAN M. CURRY, JR.
Associate Engineer with Nicholas S. Hill, Jr., Consulting Engineer, New York City

ON SOME recent intercepting sewer construction it was necessary to divert the discharge from certain sewers through existing relief outlets while the regular outlets were being connected to the new interceptor. For such diversion it was necessary to close the regular outlets at relief manholes where no gates had been provided. Stoppers were required that could later be removed without difficulty from the manholes, which would be flooded during the operation. As the outlets to be closed were in each case larger than the openings in the cast-iron manhole frames, which were embedded in concrete pavement, it was also desirable that the stoppers should be of a collapsible type, so that they could be passed through the frames into the manholes. Plugs of the following description were therefore devised, inexpensively made and successfully used in closing sewer outlets 24 and 30 in. in diameter.



Details and installation of temporary sewer stopper

For each stopper a flat cone was manufactured from 16-gage sheet iron, with a reinforced hole formed through the metal near its edge. The diameter in projection of the cone was made about 12 in. larger than the diameter of the sewer outlet to be sealed, and the amount of "dish" about one-fifth of the cone diameter. Four wedge-shaped oak stakes were well nailed and clinched to the concave side of the cone. These reinforcing stakes were applied radially at 90-deg. intervals, with the heads of the stakes toward the center of the cone but not in contact, leaving a space 4 in. square, bounded by the tops of the stakes. A free wooden keyblock was provided, square in cross-section and of proper size to fit snugly into this space.

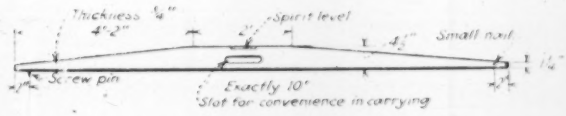
In plugging each sewer outlet, a stopper of this kind was hung upon a hook and fastened with rope to some fixed object above ground. The cone was passed through the manhole top, after being folded by hand to the degree necessary, and brought again to its original shape in the manhole chamber. The wooden keyblock was then inserted into the space at the center of the cone, thereby converting the latter from a flexible object into one having a good degree of rigidity. Each stopper was placed with its apex downstream over the sewer outlet and was held in place until the sewage had backed up sufficiently to cover it. Under the pressure of the collected sewage the cone suffered some deformation and was forced firmly into the outlet opening, where it efficiently sealed off the sewage, causing diversion of the flow through the relief outlet.

After the connecting link between each sewer and the interceptor had been completed, the stopper was pierced and crumpled by thrusting against it the end of a steel bar handled from steps above the backed-up sewage in the outlet chamber, and was then easily extracted by means of the rope to which it was secured.

Job and Office Notes

CALCIUM CHLORIDE mixed with sand or cinders is being used by the Minnesota state highway department to lessen the ice hazard on main highways. A solution of 100 lb. of calcium chloride to 13 gal. of water is used in saturating the storage pile before spreading. Treated in this manner, the sand or cinders become embedded in the ice and are not swept away by passing cars.

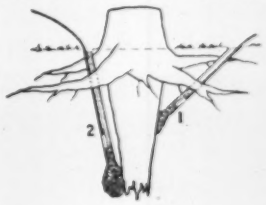
PRECISE CHAINING in extremely rough country where precipices and steep slopes predominate can be expedited by the use of a chaining block, illustrated herewith. This is shaped from a redwood stick 10 ft. 2 in. long, 4½ in. wide and ¾ in. thick.



A screw is inserted in one end, filed off and sharpened to a point. At the other end, exactly 10 ft. distant, a small nail is driven, from which to suspend a plumb bob. In chaining, the transit line is marked out with painted rods so that the block can be lined by eye. Three men do the measuring—one to hold and level the block and adjust the plumb bob, one to hold the pointed screw in the preceding mark (a depression in a stake) and line the block, and the third to drive the forward stake and mark the exact point. For accurate results it is desirable to chain forward from the summits, this method giving one fixed point on the ground from which to work.

—GEORGE E. TONNEY, San Francisco, Calif.

BLASTING tap-rooted stumps, especially in sandy soil, can be speeded up by a new method of loading developed by the explosives department of E. I. duPont de Nemours & Co., Wilmington, Del. Two charges are placed on opposite sides of the stump, as shown in the drawing. That labeled 1 is given a comparatively light load and is exploded first to remove the earth from one side of the stump. Charge 2, by means of a longer length of fuse, is given a heavier loading in order to throw the stump out of the ground.



LETTERS TO THE EDITOR

Development of the Self-Propelling Jet

Sir—We note that in the description of the work of righting the caisson of the Mid-Hudson Bridge at Poughkeepsie, published in your issue of Feb. 12, p. 280, it is stated that the self-propelling jet used in excavating under the caisson was developed by the U. S. Navy. This statement is in error. Doubtless it is an outgrowth of reports published at the time of the raising of the submarine S-51 to the effect that the jet which finally succeeded in cutting a hole under the submarine was developed on the job by a machinist mate named Waldren. The facts are that machinist's mate Waldren had seen the Victory self-propelling nozzle at work and, instead of reporting to his superiors the fact there was such a tool in existence, he proceeded to make one and earned "immortal" fame—at least for a few years, by infringing on our patents.

The self-propelling nozzle which Waldren had observed was invented by John Burns, a foreman in the sewer maintenance department of the Borough of Queens. This tool has been manufactured for the past eleven years under the exclusive license of the Self-Propelling Nozzle Co., of which the writer is the president.

One change in design was accomplished by the writer with the able assistance of Commander Elsberg, which resulted in the Vervac Nozzle—a self-balancing underwater trenching tool. Four of these Vervac nozzles were delivered to the United States Navy on Dec. 19, 1927, in order to drive tunnels underneath the sunken submarine S-4.

Referring to the 19,000-ton caisson job at Poughkeepsie: on June 13, 1928, we delivered to Blakslee and Rollins at Poughkeepsie, N. Y., the first Vervac Nozzle. On July 18 we shipped another. This indicated that the "self-propelling jet" mentioned in your magazine is not a product of the United States Navy but of the Self-Propelling Nozzle Co.

New York, N. Y.,
March 26, 1931.

H. S. ASHMUN,
President, Self-Propelling Nozzle Co.

Early Cellular Corewalls Designs

Sir—I read with much interest the article on cellular corewalls for embankment dams by C. H. Howell in the issue of Feb. 26, p. 359, and his letter published April 2; also Prof. H. E. Babbitt's letter in the March 19 issue, describing the hollow corewall of the Sylvan Dam near Melbourne, Australia.

May I give credit where credit is due by stating that Newton L. Hall was the originator of the hollow or cellular corewall for earth and rockfill dams? A patent was issued to him in 1909 covering the wall as described in Mr. Howell's article, and also adopting the same construction as an upstream or intermediate facing or paving for earth or rockfill dams, similar to that built for Stanford University at Palo Alto, described in the March 26 issue.

In 1911 an additional patent was issued to Mr. Hall, greatly amplifying his original conception of this structure. This later patent covered the application of his hollow corewall to the draining of the summit pools of hydraulically sluiced dams, and included many other advantageous features, such as drains downstream from the corewall and valve-controlled drains in the faces of the corewall itself, which would maintain a well-drained and dry embankment.

The Ambursen Co. acquired certain rights under Mr. Hall's now expired patents, and our late chief engineer, Howard L. Coburn, expanded and developed Mr. Hall's original idea. This corewall in its final form was fully described in the Ambursen Co.'s old booklet "Earth Dams and Their Adjuncts," published about 1913. In its finally developed form this type of cellular corewall with its appurtenances has many advantageous features not touched on either by Mr. Howell or Professor Babbitt, including the use of a wall with its downstream member higher than the upstream wall, so as to protect the embankment from wave action by intercepting and draining off any such water; a substantial reduction in the upstream prism of an earth or rockfill dam; the maintenance of an absolutely dry earth prism for the downstream section of the dam; and the prevention of overtopping by floods during construction.

In a modified form we are adapting the principles covered by Mr. Hall's invention to cutoff wall construction on two projects which we have under construction at the present time; the Rodriguez Dam in Mexico, where the cutoff wall will have a depth of approximately 300 ft. below the river bed; and the Ayers Island hydro-electric development for the Public Service Company of New Hampshire, where the cutoff wall has a maximum depth of 115 ft.

New York, N. Y.,
March 30, 1931.

E. H. BURROUGHS,
Vice-President, Ambursen Dam Co.

Too Many Uneducated Engineers

Sir — All discussions concerning engineering education and professional requirements seem to lose sight of the fact that the large proportion of men in engineering work must work for some public or private organization. The magnitude of most engineering works requires group work and cooperation, which prevent engineers from being as independent and individualistic as doctors and lawyers, for instance.

The average engineering school graduate, outside of novels and the movies, is not a big administrator—conceiving, designing and constructing gigantic projects all by himself—but is more likely to be an overworked and underpaid man called a draftsman. If he is a good draftsman with a high degree of technical knowledge and experience, he is supposed to reap most of his reward in the happy hunting ground to which good engineers go when they die; or he is told that he is getting valuable experience, which he can't seem to cash in.

Engineering offices, both public and private, are full of grade school graduates who have learned some small and elementary "tricks" of engineering which enable them to get by. These men are fond of proclaiming to the whole world how simple it is to become an engineer. With little or no knowledge of the fundamental principles of engineering science, these men are encouraged to compete directly with the trained man and keep down the standards of the profession. They are the most active in opposing even reasonable requirements for a professional license.

The rules of state and government civil service commissions also favor these men by allowing them more credit for a year of tracing or simple field inspection duty than a real engineer is given for a year of advanced engineering study. It is really surprising that any men go to engineering schools when it is so easy to become an engineer in ten easy lessons from a correspondence school or by owning a handbook.

V. P. MAUN.

Albany, N. Y.,
Feb. 14, 1931.

Plate-Girder Stiffeners

Sir—The article on "Stiffener Spacing for Plate-Girder Webs," by Otis E. Hovey, in your issue of March 12, 1931, p. 446, is an important contribution to the theory of design of plate girders. Mr. Hovey's formula is

$$b = 5120t\sqrt{\frac{k}{fs}}, \qquad (1)$$

Since the value of the coefficient k varies with the ratio a/b, it is not possible to make a direct solution of the spacing of the stiffeners. A very close approximation is given by the formula

$$b = 240{,}000t\sqrt[3]{\frac{t}{as^2}} \qquad (2)$$

where the value of f (factor of safety) is taken equal to 2.

For example, using the plate girder that was investigated in Mr. Hovey's article, in which $t = \frac{7}{16}$ in., $a = 72$ in., and $s = 8{,}000$ lb., a solution of formula (2) gives $b = 47.9$ in., whereas a solution of formula (1) gives $b = 47$ in. The agreement between results from the two formulas is therefore close, while formula (2) is the more easily applied.

HAROLD D. HUSSEY,
Designing Engineer,
American Bridge Co.

New York, N. Y.,
March 30, 1931.

NEWS OF THE WEEK

New City Charter Adopted by Voters of San Francisco

At a special election held March 26 the city and county of San Francisco adopted a new charter, by a vote of 59,146 to 45,581, or a majority of 13,565. At the same time an enabling act relating to the government of San Mateo County in case it should be consolidated with San Francisco County was adopted by a vote of 79,000 to 22,000. If ratified by the state legislature, as is always done with home-rule charters in California, the new charter will become effective Jan. 8, 1932.

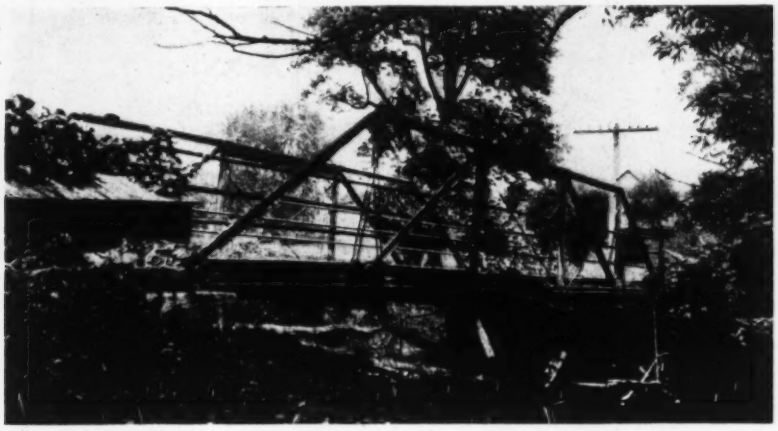
The new charter is designed to establish a plan of government somewhat similar to the so-called "strong mayor" municipal government of Detroit and Boston. It centers strong executive responsibility in the mayor with broad powers of appointment, budget responsibility and the veto. It separates the legislative and administrative functions of government; reduces the board of supervisors (city council) from eighteen to eleven members; makes the mayor the chief appointing and executive officer of the city with a "superintendent of "operations" under him, with limited authority both as to functions and the number of city departments; and creates a utilities commission in charge of the municipal street railway system, the water-works, including construction of the new Hetch Hetchy supply, the airport and any other public utility the city may in the future own.

The superintendent of operations will be in charge of single-headed departments, including public works, health, purchasing, financial and records (a new department) and electricity. He is appointed by the mayor and may be removed by him on charges. He may also be removed by a two-thirds vote of the supervisors or by popular recall.

The bond issue procedure in the city is simplified by the provisions of the new charter. Heretofore it has been necessary to have three separate ordinances approved by the board of supervisors, a procedure which required at least 90 days, before a bond issue could be presented to the voters. The new charter provides for one ordinance to pass the board of supervisors, materially reducing this time.

City of Oakland, Calif., Rejects Proposed New Charter

At a special election on March 31 the voters of Oakland, Calif., by a vote of more than 3 to 1, rejected a proposed new charter which provided for a city manager appointed by the mayor and consolidation of all departments under the mayor and city manager. The rejection automatically leaves in effect the form of government approved at the election on Nov. 4, 1930, by which a council of nine members will choose a city manager. This plan will become effective on July 1.



UNUSUAL HIGHWAY BRIDGE IN PENNSYLVANIA

The distinctive feature of this bridge, spanning White Clay Creek, in Chester County, Pa., is the trusses, which are made of railroad rails fastened with U-bolts and splice plates. The span is 50 ft. and the width of the bridge is 16 ft. A nameplate on the bridge states that it was patented March 25, 1890, by the Lane Bridge Co., and was built in 1894 by the Vulcan Road Machinery Co., of Charlestown, W. Va. The cost of the bridge complete is given on the county records as $985. Not being subjected to heavy loads, the superstructure has required practically no expense for maintenance other than the usual repairs to planking.

State Development of St. Lawrence Water Power Is Approved

DEVELOPMENT of power by the trustees for the State of New York in the international section of the St. Lawrence River is provided for in a bill passed by both houses of the state legislature. The governor has stated that he will approve the bill.

The act sets up "The Power Authority of the State of New York" as a "body corporate and politic, a political subdivision of the state, exercising governmental and public powers, perpetual in duration," consisting of five trustees to be appointed by the governor with the advice and consent of the Senate. The trustees' terms of office are for five years, one being appointed each year.

The power authority is authorized to apply to the appropriate federal authorities in this country and to federal and provincial authorities in Canada for such permits as may be necessary for its work, and to enter into agreement with the proper authorities in Ontario for the development of power in the river according to the plans prepared by the engineers of the St. Lawrence River Development Commission. The power authority is also authorized to negotiate contracts with public utilities for the transmission and sale of power. If the trustees are unable to make such contract with the utilities they are to submit to the legislature an alternate plan for disposing of the power.

The development plan prepared by the engineers of the power commission called for a single-stage development in the neighborhood of Cornwall, Ont. It was outlined in *Engineering News-Record*, Jan. 8, 1931, p. 85.

Earl Resigns From New Orleans Sewerage and Water Board

The resignation is announced of George G. Earl from the position of general superintendent of the sewerage and water board of New Orleans, La. He will not, however, entirely sever his connection with the board, but will continue as consulting engineer.

Bryson Vallas, city engineer, has been appointed to fill the vacancy caused by Mr. Earl's resignation. Mr. Vallas has been city engineer for the past six years, and during his incumbency has been in charge of the largest paving program in the history of the city. He has also played an important part in planning and establishing garbage-incineration system, a comprehensive zoning plan and the construction of several large municipal buildings.

Stringent Safety Requirements in New Ohio Building Code

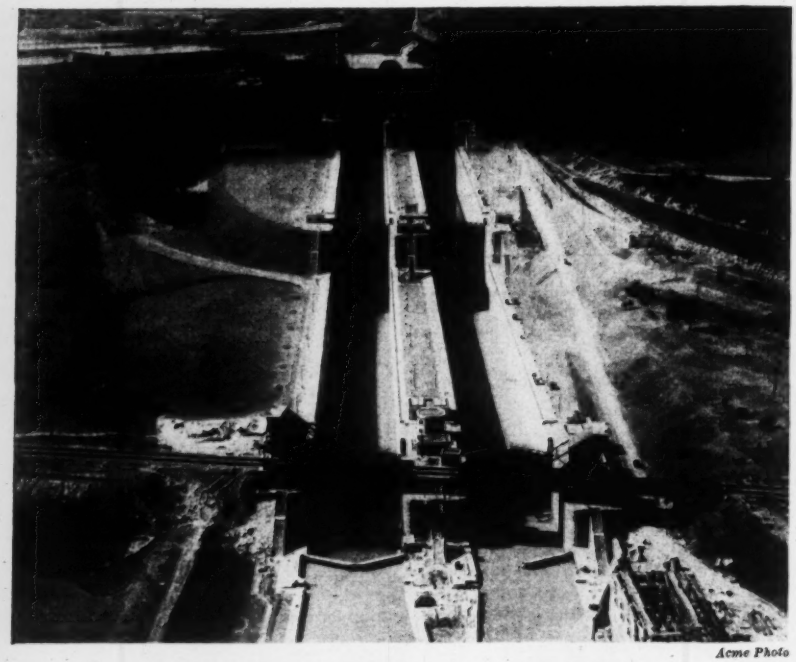
The department of industrial relations and the industrial commission of Ohio have just issued a pamphlet setting forth the revised code of safety requirements on building and construction work, which goes into effect April 15. Negligence or failure on the part of the employer to comply with the requirements is penalized by heavy added penalties levied directly against the employer. It is hoped that stricter observance of safety features will result in fewer accident claims and consequently lower insurance rates to the employer.

Bethlehem Steel Co. Acquires Longview Bridge

Control of the Longview Bridge, over the Columbia River between the states of Oregon and Washington, has passed to the Bethlehem Steel Co., through acquisition of practically the entire issue of 9,999 shares of no par common stock outstanding. Holders of first mortgage 6½ per cent sinking fund gold bonds, who were notified that the bridge company was unable to meet the semi-annual interest payment on the bonds due April 1, have been asked to defer interest on the next four coupons payable April 1, 1931, to Oct. 1, 1932, and waive operation of the sinking fund until after 1935. In return for these concessions, the holders of each $1,000 bond will receive $130 of 4½-year secured notes dated April 1, 1931, and due Oct. 1, 1935, bearing 7 per cent annual interest. They will also receive two shares of the outstanding 7 per cent cumulative preferred stock, par value $100, bearing 7 per cent dividends from March 29, 1930.

Gas Leak Caused "R-101" Crash

The board of inquiry that has been looking into the cause of the crash of the British dirigible "R-101" has announced in its findings that leaky gas bags and bad weather were the primary causes. Leakage occurred in one or more bags in the forepart of the ship. In its report the board also states that: (1) Any idea that the ship broke in the air from internal weakness may be rejected; (2) there was no failure in control of the gear; (3) the winds actually met with were not sufficient to cause the accident by themselves; (4) the longitudinal movement of the gas bags was not in itself sufficient to cause the disaster.



Acme Photo

TWIN LOCKS IN THE NEW WELLAND CANAL

This flight of three twin locks in the new Welland Canal is on the face of the Niagara escarpment below Thorold, Ont. Each lock has a lift of 46½ ft., or 14 ft. more than the locks of the Panama Canal and 6 ft. more than the maximum in the New York Barge Canal. Seven lift locks in the new canal overcame the drop of 326½ ft. between Lake Erie and Lake Ontario, which required 26 locks in the old canal. Part of the old canal is shown in the upper left corner and the summit lock of the new canal is shown at the center. Twin locks are used for the flight shown here to permit the passage of vessels in both directions at one time. The canal was practically completed last fall and it is expected that it will be ready for full operation with the opening of navigation this spring. A description of it was given in *Engineering News-Record*, Sept. 4, 1930, p. 356.

Colonel Sultan Reports on Nicaraguan Earthquake Relief

Col. Dan. I. Sultan, Corps of Engineers, in charge of the Nicaragua Canal survey and now assisting in the relief work in Managua, reported to the war department on April 3 as follows:

Situation little changed. Fire not yet under control. Refugees are being sent to near-by towns. Marines are feeding over 7,000 now and number increasing each meal. Hospitals and school buildings in Granada will soon be full of injured. One trainload dispatched to Granada April 2. Railroad line to west of Managua blocked by slides on rim of Lake Asosca. Water supply of Managua formerly came from Lake Asosca, but rim of this deep crater lake is shattered and pumping plant buried under slides. As this is only pumping equipment available attempt is being made to salvage it and establish the pumps at new intake on Lake Managua. Will remain in Managua with all available force on relief work. Our main assignments are fire fighting and assistance in establishing water supply. All army personnel working splendidly with little rest or sleep.

All Buildings Destroyed

A despatch received April 3 by the navy department from Rear Admiral Arthur St. C. Smith, says:

Made personal visit to Managua today by plane. Earthquake which destroyed Managua was of local character and as far as can be determined did little or no damage outside of a circle 10 miles in diameter with Managua as a center. Furthermore, the outlying portions of the city are much less damaged than the business portions.

The streets, paving, curbing and sidewalks are practically undamaged. There is reason to hope that water and sewer connections are little damaged. Water in mains is cut off due to destruction of pumping station, and city is without water except as can be hauled in tank wagons. Probable period of repair for water supply ten days. City is without electric lights and all wires are down.

Above ground there is practically no building, business or residential, that is not so damaged that it is unsafe for entry, let alone occupancy. Practically every building in the city must be rebuilt before further use.

Work Progressing on Railway Tunnel Under Vancouver

Favorable progress is being made on the boring of the tunnel underneath the city of Vancouver for the Canadian Pacific Railway Co. This tunnel will undermine Vancouver's business district for a length of 4,600 ft. and will connect the main lines of the Canadian Pacific Railway Co. on the shores of Burrard Inlet with the company's shops and yards at False Creek. When the tunnel is completed a single track will run throughout its entire length, and this track will eliminate two grade crossings in the city of Vancouver. Workmen have already cut into the tunnel for approximately 500 ft. It is purposed to line the tunnel throughout with concrete. It is estimated that 86,000 cu.yd. of material will have to be excavated from the bore.

Program of the Spring Meeting, Am.Soc.C.E., Norfolk, Va.

The spring meeting of the American Society of Civil Engineers will be held in Norfolk, Va., April 15-17. The board of direction will meet on April 13 and 14. The program of the technical sessions follows:

Wednesday, April 15

"The Port of Hampton Roads," by J. Gordon Bohannan, chairman, State Port Authority of Virginia; "Mississippi River Flood Control and Channel Maintenance," Major Gen. Lytle Brown, Chief of Engineers; "Transportation Problems of the Railroads," Elisha Lee, vice-president, Pennsylvania Railroad; "Coast Erosion and the Remedies," Lieut. Col. E. J. Dent, Corps of Engineers; "Aerial Commercial Transportation," Paul Henderson, president, National Air Transport, Inc.; "Army Aviation," Capt. George C. Kenney, Air Corps, U.S.A.; "Naval Aviation," Capt. Kenneth Whiting, U.S.N.; student chapter conference, W. W. Horner, chief engineer, sewers and paving, St. Louis, Mo., chairman; Southern regional meeting committee and local sections conference, John N. Chester, consulting engineer, Pittsburgh, Pa., chairman.

Thursday, April 16

Surveying and Mapping Division—"The Utility of Geodetic Control Surveys," Raymond S. Patton, director, U. S. Coast and Geodetic Survey; "Surveys for River Studies," Gerard H. Matthes, principal engineer and chief of the hydraulic division, U. S. engineer office, Norfolk, Va.; "Theory and Application of Aerial Photography in Railroad Location," M. A. Butler, consulting engineer, Ulen & Co., Norfolk, Va.

Highway Division—"Use of Convicts in Highway Construction," Henry G. Shirley, commissioner, department of highways, Richmond, Va.; "Arbitration on Public Works Contracts," Charles H. Stevens, chief engineer, department of city transit, Philadelphia, Pa., and Philip A. Beatty, staff engineer, bureau of municipal research, Philadelphia, Pa.

Waterways Division—"The Port of Baltimore," Lieut. Col. Warren T. Hannum, Corps of Engineers, U.S.A., district engineer, Baltimore, Md.; "The Waterways of the National Capital," Major Joseph D. Arthur, Jr., Corps of Engineers, district engineer, Washington, D. C.; "The Atlantic Intracoastal Waterway," Major Gordon R. Young, Corps of Engineers, U.S.A., district engineer, Norfolk, Va.

Sanitary Engineering Division—"Norfolk's First Essentials for Sanitation—Water Supply and Sewerage," Walter H. Taylor, III, director of public works, Norfolk, Va.; "Norfolk City Water Supply," John N. Chester, consulting engineer, Pittsburgh, Pa.; report of committee on water-supply engineering, Frank A. Barbour, consulting engineer, Boston, Mass., chairman; report of committee on New Jersey sewage experiments, George T. Hammon, consulting engineer, Brooklyn, N. Y., chairman.

On Thursday afternoon, April 16, there will be a boat trip around the harbor, followed by an informal dinner and entertainment in the evening. On Friday the members and their guests will be taken on an all-day motor trip to points of historical and engineering interest, with luncheon at William and Mary College, Williamsburg, Va.

City Planning Principles Win in St. Paul, Minn.

The long-drawn-out controversy over the location of a $1,500,000 state office building in St. Paul, capital of Minnesota, has been settled by a unanimous vote in the Senate and a vote of 109 to 6 in the House on a bill which places the building in accordance with the city plan.

In 1929 the legislature appropriated $1,500,000 for this building and created a commission to construct the building forthwith. The building commission shortly after its appointment decided by a vote of 5 to 2 to place the office building in the rear of the Capitol. The City Planning Board of St. Paul immediately took a stand on the matter, aroused the interest of civic leaders throughout the state and secured support from societies, clubs and newspapers with the result that the building commission gave up the right to select the site and referred the matter back to the state legislature.

At a meeting on March 30 the building commission definitely located the office building in accordance with the mandate of the legislature and in accordance with the Cass Gilbert plans for Capitol approaches prepared at the request of the city of St. Paul and as published in the "Plan of St. Paul." Condemnation proceedings on the land will begin immediately.

The location faces the axis of the Capitol, makes the building a companion to the state historical building, already constructed, and forms the nucleus for a grouping of public and semi-public buildings along an axial approach which the Capitol faces.

State May Take Over Pennsylvania Township Roads

A bill has been introduced in the Pennsylvania legislature providing that the state highway department not later than Aug. 15 next shall take over approximately 20,000 miles of township highways, comprising 25 to 27½ per cent of township roads in each county. The bill has the backing of Governor Pinchot.

BIG TUJUNGA DAM NO. 1, CALIFORNIA, LOOKING DOWNSTREAM

This view shows more than 55 per cent of the concrete poured and more than 90 per cent of excavation completed. The plans for the dam require 90,000 cu.yd. of excavation and 90,000 cu.yd. of concrete. The dam is arch type, 249 ft. above lowest point in foundation, and 300 ft. long. Construction is being done by Edwards, Wildey & Dixon, contractors, for the Los Angeles County Flood Control District, E. C. Eaton, chief engineer of the district.

Contestants for Bridge Design Prizes Chosen

Out of 138 students of engineering and architecture who submitted preliminary drawings in the 1931 bridge design competition held by the American Institute of Steel Construction, ten engineering and ten architectural students have been selected to complete their designs and submit them for final judgment. Students in 30 institutions in nineteen states and provinces in the United States and Canada participated in the preliminary competition, which was judged on April 2 by a jury consisting of Ralph Modjeski, consulting engineer; Shortridge Hardesty, consulting engineer; H. H. Murdock, architect; Clinton Mackenzie, architect, and F. E. Schmitt, editor of *Engineering News-Record*. The students selected to submit finished drawings will compete for three prizes in each division. The first is $500, second $250 and third $100. These drawings will be judged on May 1 next by the same jury.

Air Travel 1,000 Per Cent Safer

Operation of the scheduled air transport lines of the United States with only two passenger fatalities during the last six months of 1930 resulted in an increase of approximately 1,000 per cent in the number of passenger-miles flown per passenger fatality over the number of miles similarly flown in the first half of last year, according to Clarence M. Young, assistant secretary of commerce for aeronautics. Operators of scheduled lines flew a total of 51,482,633 passenger-miles during the last half of 1930. In all of this flying there was one fatal accident, involving two passengers. For each of these two passenger fatalities, therefore, the scheduled lines flew 25,741,316 passenger-miles. As a contrast during the period January to June, 1930, the number of passenger fatalities was 22, making the passenger-miles flown per passenger fatality 2,375,664.

A comparison of records of all scheduled operations (mail, passenger and express) for the last half of 1930 with those of the corresponding period of the previous year follows:

	July-Dec., 1930	July-Dec., 1929
Miles flown in scheduled operations	20,042,475	15,940,161
Total number of accidents	47	76
Miles flown per accident	426,436	209,739
Fatal accidents	3	15
Miles flown per fatal accident	6,608,825	1,062,677

Of the various causes of accidents to aircraft in this kind of flying, weather was the most troublesome, accounting for 32.02 per cent. The next largest percentage was charged to power plants, 22.34 per cent. Others were as follows: personnel, 15.32 per cent; airplane failures, 14.9 per cent; airport and terrain, 11.70 per cent; darkness, 0.53 per cent; other causes, 3.19 per cent.

Accident reports of the aeronautics branch of the department of commerce are based on the findings of its accident board, composed of two pilots, a flight surgeon, an aeronautical engineer, a lawyer versed in air law, and a statistician.

Public-Works Contractors in Nevada Must Obtain License

Under terms of an act approved March 27 by the Nevada state legislature, all contractors engaging in public works within the state must be licensed. The act applies to all municipal, county and state construction projects where the contract exceeds $10,000. Subcontractors holding contracts in excess of this amount are required to obtain a license. A license must be obtained before a contractor may submit a proposal for work. The state controller has been designated as registrar for the purposes of the act.

A fee of $200 is charged for the initial issuance of a license, and a charge of $100 is made for annual renewals. The registrar is compelled to issue a license to every applicant. In case of complaint against a contractor, the registrar is empowered to make decisions, and if such decisions are unsatisfactory to either party, appeal may be made to the district court. An appeal by the contractor automatically suspends the revoking of a license until the case is settled by the courts. Complaint against a contractor may be made on three charges: (1) abandonment of contract without legal excuse; (2) diversion of funds received on a contract for use on any other contract with intent to defraud; (3) the doing of any willful fraudulent act by the licensee as a public-works contractor in consequence of which another is substantially injured.

A suspended license may be restored by the registrar or court upon proof that the cause of complaint has been remedied, but a cancelled license cannot be reissued within one year after cancellation. A penalty of a $500 fine or six months imprisonment, or both, is provided for operating without a license.

Two New Irrigation Systems Planned in Texas

Surveys have been completed and bids have been asked for the construction of two irrigation systems in Cameron County, Lower Rio Grande Valley, Texas, which will involve an expenditure of approximately $1,500,000, bonds for which have been voted. Cameron County Water Improvement District No. 13, of which P. W. Samuels, of Brownsville, is president, will open bids on April 25 for constructing an irrigation system to cost approximately $500,000, and the Cameron County Water and Irrigation District No. 14, of which L. P. Stover, of Brownsville, is president, will open bids on April 25 for similar improvements to cost approximately $800,000. The new systems when completed will open several thousand acres of land to agricultural development.

State Cannot Regulate Road's Forces on Grade Eliminations

Application of the Dunmore act, passed by the New York legislature in 1930 and regulating the hours and wages of grade-crossing elimination laborers, does not extend to the railroad's own employees, according to a ruling handed down on April 4 by Judge Staley, of the state supreme court. By the decision an injunction is granted against the state department of labor from imposing the provisions of the act on the railroads when only their own forces are employed.

However, Justice Staley's decision of last December in which the law was found valid when the elimination work was done by contract is in no way modified by his recent ruling. By the statute the Public Service Commission is given authority to determine whether or not the elimination shall be done by contract. When done by contract, laborers are restricted to an eight-hour day and must be paid the rate of wages prevailing in the locality where the elimination work is being done.

Concrete Paving Bids 28 Per Cent Below Last Year

The accompanying two tables give concrete paving prices of jobs reported by *Engineering News-Record* let last month and in March, 1930. The tables include all contracts that reported both square yardage and price, so that the unit price could be computed. The tables therefore are roughly comparable. The current average price is $1.83 per square yard, compared with $2.55 in 1930, indicating a cost reduction of 28 per cent.

CONCRETE PAVING BIDS IN MARCH, 1930

	Sq.Yd.	
Ark., DeQueen	53,000	$2.57
Ark., Earle	18,000	1.74
Calif., Long Beach	20,000	1.72
Calif., Los Angeles	21,000	3.30
Calif., Monrovia	39,000	1.89
Calif., Riverside	12,000	1.99
Ill., Alton	14,000	2.50
Iowa, Davenport	5,000	2.48
Iowa, Olin	16,000	1.98
Iowa, Ottumwa	12,000	2.35
La., Alexandria	24,000	2.46
La., Jena	3,000	2.83
La., Tallulah	9,000	3.89
Md., Baltimore	11,000	1.94
Md., Baltimore	9,000	2.56
Minn., Mankato	1,000	1.40
Miss., Tunica	8,000	2.82
Mo., West Plains	27,000	1.69
Tex., Beaumont	55,000	3.78
Tex., Hale Center	10,000	2.93
Tex., Hallettsville	18,000	3.16
Tex., Waco	17,000	2.06
Average	18,000	$2.55

CONCRETE PAVING BIDS IN MARCH, 1931

Calif., Palo Alto	34,000	$1.89
Indiana State	142,000	1.36
Indiana State	81,000	1.70
Indiana State	404,000	1.60
Indiana State	27,000	2.00
Ill., Wilmette	90,000	2.32
Iowa, Marquette	9,000	1.85
Kansas State	31,000	1.65
Kan., Kansas City	53,000	2.29
La., Lafayette	56,000	2.74
Ore., Portland	19,000	1.73
Md., Baltimore	11,000	1.80
Md., Baltimore	7,000	2.00
Md., Baltimore	10,000	1.95
Tex., Austin	70,000	2.25
Wis., Kenosha	36,000	2.00
Average	67,000	$1.83

Colonel Sultan Is Named on Interoceanic Canal Commission

Lieut. Col. Daniel I. Sultan, Corps of Engineers, U. S. Army, now in Nicaragua making a survey of the route for the proposed Nicaraguan Canal, has been named by President Hoover as a member of the Interoceanic Canal Commission to succeed the late Lieut. Gen. Edgar Jadwin. Colonel Sultan was graduated from the U. S. Military Academy in 1907 and has served as district engineer, Savannah, Ga.; on fortification work in the Philippine Islands; on lock and dam work in the Ohio River, and has been for three years a member of the board of engineers for rivers and harbors. He was an instructor of engineering at the U. S. Military Academy for four years and at the Engineering School, Fort Humphreys, Va., for three years.

WASHINGTON NOTES

By PAUL WOOTON
Washington Correspondent

Earthquake Menace to Canal in Nicaragua Minimized—Department Not to Fix Wage Rates in Advance

ALTHOUGH the recent earthquake in Nicaragua undoubtedly will be used in Congress as an argument against proceeding farther with the plans to dig an interoceanic canal across that country, the army engineers have amassed data that minimize the earthquake menace. It is stated by Gen. Lytle Brown, Chief of Engineers, that the records show that there have been more earthquakes in Panama than in Nicaragua.

In the report of the Isthmian Canal Commission of 1901 special reference was made to the danger of earthquakes and volcanic eruptions. It was shown that from the time of the Spanish conquest to 1886, 24 earthquakes were felt in Panama and fourteen in Nicaragua. The conclusion was reached that the danger from earthquakes in both regions is about the same. Bringing the report up to date, the army engineers have found that from 1886 to 1929 there have been sixteen earthquakes in Panama and fourteen in Nicaragua. Col. Dan I. Sultan, the officer in charge of the Nicaraguan Canal survey, has reported to Washington that the recent shocks that destroyed Managua were not felt along the route of the canal, which is approximately 60 miles away.

Labor Department Not to Determine Wage Rates in Advance

In accordance with the terms of the Davis-Bacon bill enacted shortly before the adjournment of Congress, a clause is being inserted in public contracts for the construction of government buildings requiring that local wage rates be maintained. If the invitations for bids were issued prior to March 2, the date of the passage of the bill, the regulations do not apply. No provision is made in the bill for a determination of local wage rates until there is a dispute. Labor department officials state that they will not make an advance determination of wage rates even though specifically requested to do so by a government department about to let a building contract. It is pointed out that the labor department would have to ascertain the wages paid workers in the building industry in practically every important city in the country.

A.G.C. to Conduct Wage Survey

Local wage surveys to provide accurate data as to the range of pay prevailing for the building trades and labor in every community in the United States, to be conducted by the Associated General Contractors of America in cooperation with its more than 100 chapters and branches, were planned by the executive cabinet of the association which met March 28. A canvass of the local groups of contractors is to be conducted at once to determine if accurate wage data can be compiled. The surveys would be made to enable general contractors to arrive at some conclusion as to the actual prevailing wage that they must pay on government construction work under the Davis-Bacon act and to fortify them against charges of violation of this law. The decision of the executive cabinet is taken as an indication that organized general contractors have no intention of passively submitting to arbitrary decisions as to what constitutes the "prevailing rate of wage" in a given community under the new law, which places final decision with the secretary of labor. It has been the contention of the A.G.C. that the law should provide, or be so administered, that the rate of wage on a government project in a given community would be predetermined by the contracting officer and stipulated in the contract or specifications.

The New River Decision

In deciding that the proposed project of the Appalachian Electric Power Co. in New River would affect the interests of interstate and foreign commerce the Federal Power Commission was influenced, among other things, by the fact that the Kanawha gets 80 per cent of its water from New River. The Kanawha in turn supplies half the water at the point of its confluence with the Ohio.

The commission did not pass upon the question of navigability. It was not willing to say that Congress had exceeded its authority in defining navigation in the water-power act. It is true that Congress once appropriated money for the improvement of New River. It also is true that it later withdrew the appropriations on the ground that it was not practicable to improve the stream. The river formerly carried a substantial commerce, but this was on local portion of the stream. There was no through business. Efforts to use the river or any portion of it for commerce ultimately proved unsuccessful. There are 24 bridges over New River. Three of these were authorized by Congress; the remaining 21 were constructed without federal permits and nothing has ever been said about it. There is also the possibility that New River might be developed by a series of locks and dams such as are planned on the Tennessee River. In view of all of this conflicting evidence the commission prefers to leave it to the courts to decide whether or not New River is a navigable stream.

The Business Outlook

The beginning of the second quarter brings no break in the monotonous movement of business along the bottom on which it has been bumping for five months. Steel has lost a little of its momentum, as it usually does after March, automobile output is increasingly cautious and electric power production reflects little growth in general industrial activity. But construction is encouragingly active and car loadings suggest an increasing movement of merchandise for spring trade. Best of all, the drought is routed and crops are promising.

—The Business Week, April 8.

Hurley Not in Entire Accord With Flood-Control Report

Public announcement was made recently by Secretary of War Hurley that he does not approve all of the features of the report made by the army engineers on their restudy of the flood-control project. This report, which upholds the basic principles of the existing plan, was sent to the flood-control committee shortly before Congress adjourned. Particularly in reference to the controversy concerning the elimination of the Boeuf floodway is Mr. Hurley still openminded. The army engineers having studied the technical points involved, he is willing to rely upon their ability in this respect, but concerning the economic features he feels that the engineers are not prepared to speak with the same degree of authority.

Rates on Pipe Declared Reasonable

Increased rates applying to cast-iron pressure pipe since March 20, 1930, were upheld as reasonable in a proposed report to the Interstate Commerce Commission this week by Examiner T. P. Wilson on complaint of James B. Clow & Sons and the U. S. Pipe & Foundry Co. The pipe foundries charged that the commission's order placing cast-iron pipe on the same rate basis as other iron and steel articles at 22½ per cent of first class has raised the rates on pipe from the Northern foundries to destinations throughout official classification territory to an excessive level. Examiner Wilson recommended that relief should be accorded only to the extent of reducing the carload minimum weight on pipe over 18 in. in diameter from 40,000 to 34,000 lb.

New Official Set-Up for American Bridge Co.

A new executive engineering set-up for the American Bridge Co. was approved by Joshua A. Hatfield, president, on March 28. The rearrangement of titles and duties resulted from the death of James H. Edwards, chief engineer, on Aug. 14, 1930. Since that date the company has operated without a designated chief engineer, although Mr. Edwards' duties have been performed by Otis E. Hovey, assistant chief engineer. Under the recently announced set-up, Richard Khuen, Jr., is promoted to chief engineer from the position of general manager of erection. Mr. Khuen will maintain his present office in Pittsburgh. Albert Reichmann, formerly division engineer in Chicago, has been promoted to assistant chief engineer, with office in Chicago. Otis E. Hovey, formerly assistant chief engineer, has been promoted to consulting engineer and will maintain his office in New York. The position of general manager of erection, vacated by Mr. Kheun, will be taken by C. S. Garner, formerly manager of foreign erection; Mr. Garner will supervise all erection work, both domestic and foreign.

Personal Notes

R. D. STAUCH, of Sonora, Calif., has been elected county surveyor for a term of four years.

LEE S. TRAINOR has been appointed chief engineer of the construction division of the National Lime Association.

E. M. SNECKENBERGER, for sixteen years city engineer of Billings, Mont., has been appointed city manager of Rapid City, S. D.

ALFRED J. CLEARY, consulting engineer, San Francisco, Calif., has been appointed executive secretary to Mayor Rossi, San Francisco. Mr. Cleary was designer and engineer on many municipal engineering projects in San Francisco, and from 1915 to 1920 was chief assistant city and county engineer. He is a member of the American Society of Civil Engineers.

HALSEY W. THAYER, for the past six years in charge of the water system transportation division of the Los Angeles department of water and power, has been appointed superintendent of equipment for the department. He will have charge of all transportation and general construction equipment.

CHARLES R. VANNEMAN, chief engineer of the Public Service Commission, Albany, N. Y., has resigned and formed Charles R. Vanneman, Inc., for the general practice of engineering, particularly as it affects public utilities. Mr. Vanneman will be president of the new corporation, which will have offices in Albany. Other members of the firm are NEWELL L. NUSSBAUMER, of Buffalo, vice-president, and RAY D. DIEHL, also of Buffalo, treasurer. Messrs. Nussbaumer and Diehl have been actively engaged in municipal engineering work in Buffalo and vicinity.

CHARLES S. HUBBELL is president, H. H. WALLER is vice-president and treasurer and E. J. WATKINS is secretary of the Hubbell & Waller Engineering Corp., reincorporated and expanded to embrace general contracting in addition to engineering, surveying and hydro-electric work in Alaska, where the company has been in operation for the last eighteen years. Headquarters will remain in Seattle.

JARVIS J. BAIN, colonel, Corps of Engineers, U. S. Army, district engineer in the Pittsburgh district since 1927, has been notified of his transfer to instructor in the Command and General Staff School at Fort Leavenworth, effective Aug. 1.

J. F. WARD, who has been engaged in general contracting work in Seattle, Wash., for twelve years, has formed the Engineering Construction Co., with himself as president. Associated with him are E. R. WILLARD and A. G. CHERRIL.

CHARLES MACDONALD, county engineer of Westchester County, New York, for the last sixteen years, has offered his resignation, effective May 1, to become consulting engineer for the Charles H. Sells General Engineering Co., of Pleasantville, and the A. E. Ottaviano Highway Reconstruction Co., of Croton.

SOCIETY CALENDAR

AMERICAN SOCIETY FOR TESTING MATERIALS, Philadelphia; 34th annual meeting, Chicago, June 22-26.

AMERICAN SOCIETY OF CIVIL ENGINEERS, New York; spring meeting, Norfolk, Va., April 15.

AMERICAN WATER WORKS ASSOCIATION, New York; annual convention, Pittsburgh, Pa., May 25-29.

AMERICAN WELDING SOCIETY, New York; annual meeting, New York City, April 22-24.

AMERICAN INSTITUTE OF QUANTITY SURVEYORS will hold its sixth annual convention May 25-27 in Cincinnati, Ohio. At that time prizes will be awarded in the competition for the best quantity surveys on each trade in the building industry. Competition for these prizes is open to all quantity surveyors and estimators connected with building construction, and contestants are requested to forward their surveys to the secretary, F. E. Dischner, 910 Empire Bldg., Detroit, Mich., before May 15, when the entries close.

AMERICAN PUBLIC HEALTH ASSOCIATION will hold its 6th annual convention in Montreal, Sept. 14-17.

AMERICAN WELDING SOCIETY will hold its annual meeting in New York City, April 22-24. Among the papers that will be presented are: "Some Examples of Welding in Structural Steel Work," by D. C. Tennant, structural engineer, Dominion Bridge Co.; "Formulæ for Eccentrically Welded Connections," by Odd Albert, bridge designer, New Jersey highway commission; "Some Tests of Gas-Welded Structural Joints," by H. H. Moss, Linde Air Products Co.; "The Effect of Welding Procedure on Shrinkage Strains in Butt-Welded Joints," by C. H. Jennings, Westinghouse Electric & Mfg. Co.

ARIZONA SECTION, American Society of Civil Engineers, will hold its spring meeting on April 18 at Tucson in conjunction with the University of Arizona student chapter. Some of the subjects that will be discussed are: "The Colorado River Problem," by Thomas Maddock, consulting engineer, Phoenix; "Present Status of Welding in Steel Construction," by Emmet Marx, consulting engineer, Tucson; "The $12,000,000 Rio Grande Conservancy Project at Albuquerque, N. M.," by Robert H. Rupkey, Albuquerque; "Recent Power Development at Niagara Falls," by J. H. Knost, Westinghouse Electric International Co.

ENGINEERING SOCIETIES OF BOSTON at a meeting on the evening of April 15 will listen to a lecture by V. R. Jacobs, assistant sales manager of the Goodyear-Zeppelin Corporation, Akron, Ohio, on the design, construction and operation of the largest airships in the world now nearing completion.

LOS ANGELES SECTION, A.S.C.E., Sanitary Group, met on March 25. The speakers of the evening and their subjects were: W. H. Adams, civil engineer, Los Angeles county surveyor's office, "Infiltration of Groundwater Into Sewers"; P. H. Deming, president, Deming Corporation, "Sewer Pipe Joints," and P. Diederich, water-works superintendent, Glendale, Calif., "Recent Experience With Glendale Chevy Chase Reservoir."

NEW ENGLAND WATER WORKS ASSOCIATION will hold its annual convention in Boston, Sept. 29 to Oct. 2.

Obituary

GEORGE H. ANGELL, superintendent of construction on the hydro-electric project at Safe Harbor, Pa., died of heart disease on April 6. He was 64 years old. Mr. Angell worked his way up from laborer to superintendent and held responsible positions on the construction of the Kensico Dam at White Plains, N. Y., the Ontario Power Co.'s project on the Canadian side at Niagara Falls, the Conowingo Dam and the Holtwood Dam.

NELSON S. GREENSFELDER, advertising manager of the Hercules Powder Co., died suddenly of pneumonia in Wilmington, Del., on April 5. Mr. Greensfelder was born in 1891 and was graduated from the Colorado School of Mines in 1913. He had been advertising manager of the Hercules company since 1924. Mr. Greensfelder was one of the organizers of the National Industrial Advertising Association, and afterward became its president. Other organizations in which he took a prominent part were the American Mining Congress, the American Institute of Mining and Metallurgical Engineers, the National Crushed Stone Association, the National Safety Council, the Institute of Makers of Explosives and the Association of National Advertisers.

JACOB WERNLI, for 40 years draftsman on the staff of *Engineering News-Record*, died at the age of 71 on April 4. He began his long term of service on *Engineering News* in 1891, when Charles W. Reinhardt, creator of the widely known system of lettering that bears his name, was chief draftsman. Mr. Wernli retired from active work a year ago, but continued to maintain keen interest in the illustration work of the paper.

Construction Equipment and Materials

Ingersoll-Rand Compressors and Drills for Hoover Dam Job

Six Companies, Inc., contractor for the Hoover Dam, has placed an order with Ingersoll-Rand Co., New York, for all compressor and rock-drilling equipment that will be required on the project. The stationary compressor plant will have a combined output of 25,000 cu.ft. per minute, believed to be the largest central air-compressing plant ever installed for furnishing high-pressure air for tunnel construction. The compressors will be of the direct-connected two-stage type, electrically driven, with five-step clearance control.

The stationary plant will supply air for driving the four 57-ft. diversion tunnels, each 4,000 ft. long, and the various penstock tunnels, and excavating the spillways and main dam foundations. Portable compressors will supply power for small drills used in scaling off the canyon walls. Including all tunnels and outside work, the rock excavation is estimated at 5,800,000 cu.yd.

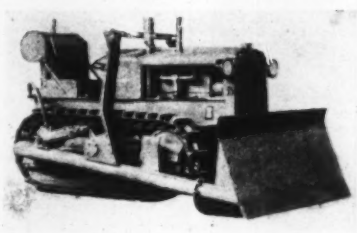
Exact methods to be used in driving the tunnels have not yet been announced. Work on the tunnels is expected to start at once. The diversion tunnels will be completed in about eighteen months.

"Ascoloy" to Go Under Class Name "Allegheny"

The Allegheny Steel Co. will henceforth use the name "Allegheny" in connection with its whole group of chromium and chromium-nickel alloys. The 18-8 alloy will retain the name "Allegheny Metal;" the alloys hitherto called "Ascoloy" 33, 44, etc., will be known as "Allegheny" 33, 44, etc. This step is taken to simplify the complex nomenclature of alloys.

New Hydraulic Bulldozer

For attachment to either the Allis-Chalmers Monarch 35 or the Caterpillar 30 tractor, the Baker Mfg. Co., Springfield, Ill., has brought out a hydraulic bulldozer of extremely sturdy construction. As is shown in the illustration, it consists of a moldboard 40 in. high and 80 or 88 in. wide supported by push beams hinged at the rear axle. Twin hydraulic pressure cylinders, one on each side of the tractor, are direct-connected to lifting cranks mounted on Timken roller bearings. The moldboard can be moved up and down through a range of 26 in. and will cut from 6 to 10 in. below ground level. Power for lifting is supplied by a hydraulic pump connected to the tractor engine transmission.



Tractor-mounted hydraulic bulldozer

Cart for Handling Cement

Efficient transportation of bulk cement is the purpose for which the C. S. Johnson Co., Champaign, Ill., has developed a new piece of equipment known as the Johnson KoneKart. As shown in the illustration, this consists of a cone-shaped galvanized steel container mounted on steel- or rubber-tired wheels and equipped with a bottom discharge operated by a foot toggle valve. Filling is speeded up by the large top opening and also by a support that permits tilting the cart, thus lowering the shoveling height. Three sizes are available.

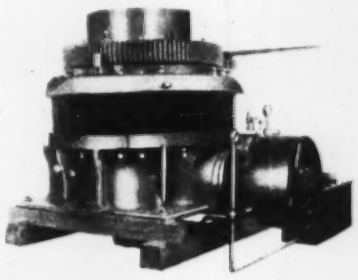
Bottom-discharge concrete cart

Wood Floor Blocks

Flooring blocks in various grades of wood, resulting in variegated colors which can be laid in geometrical or modernistic patterns, are being made in types suitable for homes, public buildings and industrial plants by a new organization, the National Wood Products Co., Howard City, Mich. Standard sizes available are 6x12, 9x9, 6x6 and 12x12 in. Although the standard thickness is $\frac{25}{32}$ in., blocks will also be available in other thicknesses up to 1⅛ in. Materials available include oak, maple, beech and birch. The blocks are treated with transparent Pen-O-Treat wood preservative and are laid in a special mastic composition which retains its elasticity indefinitely and also deadens sound and aids in the elimination of vibration. A new type of interlocking joint is used on all sides of each block, the special tongue-and-groove profile making it possible to lay the floor without disturbing the mastic underneath.

Adjustable Cone Crusher With High Reduction Ratio

Gyratory crushers, when set up close for fine reduction, frequently become clogged because the rock fails to discharge readily and gathers in a non-yielding mass at the bottom of the head. This difficulty is obviated in a new Telsmith cone crusher brought out by the Smith Engineering Works, Milwaukee, Wis. In this machine the conical head gyrates so rapidly that every piece of rock is pinched several times during its progress through the unit. Very little oversize material reaches the discharge opening. As the axial line of the eccentric intersects the axis of the crusher at a point just above the feed level, the gyration of the head is longest at the bottom, diminishing to a slight movement at the point of feed, but increasing again in the projecting portion of the head and the mantle lock, which extend above the feed opening. This projecting knob prevents the bridging of large rocks in the receiving hopper. The reduced stroke at the point of feed automatically regulates the flow of rock into the bowl, preventing overfeeding and choking.



Cone crusher for producing fine sizes of rock

A spring release which holds the upper frame effectively checks packing and eliminates danger of breakage by tramp iron. These springs retain the upper crushing member in normal position under ordinary conditions, but allow upward movement to relieve momentary stresses due to packing or tramp iron.

Use of a segmental wedge ring, sealed against grit and water, allows quick adjustment of the crusher with a wide range of discharge opening and a rigid lock during operation. Adjustment can be made without stopping the machine.

(Continued on page 632)

Current Construction Unit Prices

Dredging in Summit County, Ohio

COMMISSIONERS of Summit County, Akron, Ohio, opened bids on Jan. 14 for dredging, widening and straightening 8,700 ft. of Mud Run from Tuscarawas River to Norway Ave., 12 and 16 ft. wide. Eight bids were received, averaging $29,738. Contract was let to Louis Crano, Inc. (second low), 206 Crosby St., Akron, for $28,010. Unit prices are given of lowest three bidders: A, J. F. Ott, Cleveland; B, Louis Crano, Inc.; C, E. H. Amlin, Barberton.

			A	B	C
42,000	cu. yd.	excav.—ditch	$0.12	$0.11	$0.15
700	cu. yd.	excav.—bridge abutments	2.00	2.50	2.50
1,000	cu. yd.	hauling earth spoil	.25	.20	.25
100	cu. yd.	conc. 1-2-3 mix	16.00	18.00	16.00
325	cu. yd.	concr. 1-2½-4 mix	14.00	16.00	14.00
1,600	lin. ft.	hardwood piling furnished	.50	.60	.55
1,600	lin. ft.	hardwood piling driven	.40	.50	.45
10,500	sq. ft.	interlocking steel sheeting	.80	.90	.90
2,000	lb.	reinforcing steel	.05	.04	.04
40	M. b.ft.	oak lumber in place—bridges	60.00	70.00	60.00
—		Removing portion of culvert	300.00	200.00	200.00
—		Premium State insurance	400.00	150.00	350.00
Totals			$25,880.00	$28,010.00	$28,530.00

Second Twin City Lock at Minneapolis

WHEN, early in 1930, the Twin City lock in the Mississippi River at Minneapolis was reconstructed (*Engineering News-Record*, April 3, 1930, p. 595), provision was made for a second lock of the same dimensions, 56x400 ft. in plan by 60 ft. deep. Contract for this lock was let in January, 1931, for $683,600. The work, as the drawing shows, includes a land wall, upper and lower guide walls, excavation of approaches, lock gates, stoney gate valves, and the other operating machinery. The structure is on a sandstone ledge, and excavation is classed as common and rock. Common includes all material above bedrock, except boulders exceeding 9 cu.ft. and any material requiring blasting. Excavation for the approaches is principally sandstone ledge covered with sand gravel, boulders, slab rock, a growth of timber and a concrete guide wall. The cut ranges from El. 700 to El. 820 for a distance of 2,500 ft. The average price of the lowest three bidders on the whole job was 87c. for rock and 82c. for common. These two items form 31 per cent of the total cost.

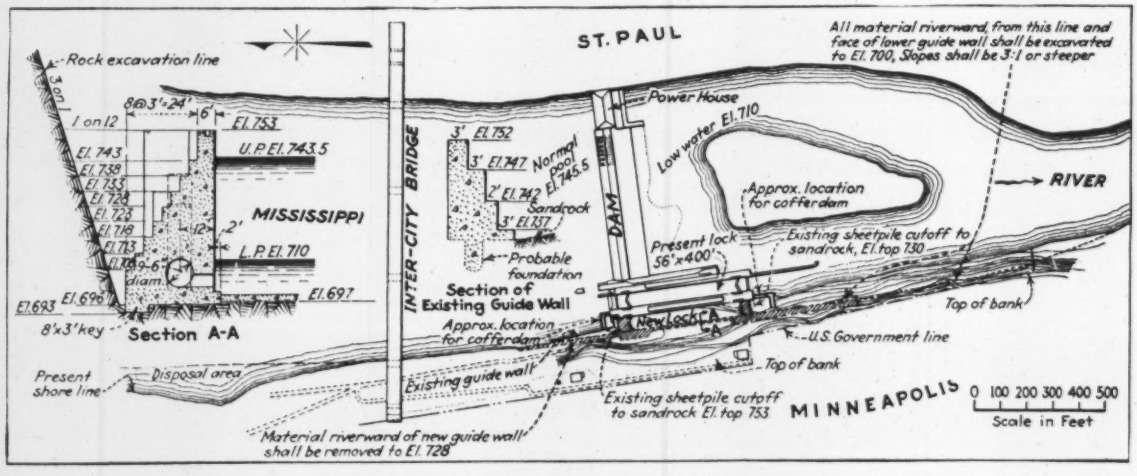
The largest item is 32,500 cu.yd. of class B mass concrete at $7.30 for the lowest bidder, and $7.49 and $7.70 for the next two. Class B has five bags of cement per cubic yard and a compression strength at 28 days of 2,400 lb. per sq.in.

A comparison between current bids and those on comparable poundages of the same metals for the first lock are given below. The figures are averages of the lowest three bidders on each contract.

	January, 1931	December, 1929
Structural steel	$0.0754	$0.090
Steel forgings	.1343	.134
Nickel steel	.2218	.400
Steel reinforcing	.4167	.0425
Steel castings	.1119	.1406
Iron castings	.0983	.1180
Bronze	.5163	.9180

Fifteen bids were received for the lock construction, averaging $870,000. Unit prices are given of the lowest three, of St. Paul: A, A. Guthrie & Co., Inc., 1300 Builders' Exchange, $683,600 (contract); B, Martin Wunderlich-Henry C. Struchen, 640 Shubert Bldg., $733,325; C, P. L. Connolly, 2234 University Ave., $746,196. The contractor who built the first lock was sixth, at $838,198. Lieut. Col. Wildurr Willing is district engineer.

			A	B	C
797	lin. ft.	cofferdams (locks and guide walls)	$49.00	$34.00	$5.00
265,000	cu. yd.	rock excav.	.65	.845	1.11
2,990	cu. yd.	rockfill (crib)	1.00	1.50	1.05
65,000	cu. yd.	common excav.	.65	.75	.40
40,000	cu. yd.	fill	.20	.22	.12
32,500	cu. yd.	conc. (mass) class B	7.30	7.49	7.70
350	cu. yd.	concrete (reinf.) class A	21.45	11.29	8.00
1,344	ft. b.m.	oak timber	.20/ft.	200.00	200.00
190,000	ft. b.m.	common timber	.06/ft.	45.00	60.00
16,000	ft. b.m.	select yellow pine	.10/ft.	77.00	100.00
5,975	lin. ft.	timber piles	.40	.44	.35
146	lin. ft.	pipe, extra strong 2½ in.	2.10	2.24	1.30
942	lin. ft.	pipe, extra strong, 3 in.	2.65	2.79	1.40
1,237	lin. ft.	pipe, extra strong, 4 in.	3.15	3.34	2.00
188	lin. ft.	pipe, standard, 3 in.	2.40	2.51	1.00
1,250	lin. ft.	pipe, standard 4 in.	2.10	2.24	1.50
1,340	lin. ft.	conduit, 1½ in.	.50	.34	.30
40	lin. ft.	conduit, 1 in.	.25	.25	.30
36	lin. ft.	conduit, ¾ in.	.20	.22	.30
100	lin. ft.	tile gages	5.00	4.00	4.00
571,200	lb.	structural steel	.085	.0761	.06½
17,450	lb.	steel forgings	.15	.1328	.12
1,165	lb.	nickel steel	.25	.1654	.25
75,200	lb.	steel reinforcing rods	.05	.035	.04
196,950	lb.	steel castings	.095	.1418	.10
8,075	lb.	iron castings	.095	.0998	.10
18,800	lb.	bolts	.065	.063	.10
795	lb.	bronze	.50	.4489	.60
6,300	lb.	babbitt	.20	.11	.20
100	lin. ft.	drilling anchor rod holes	1.00	1.00	2.00
1	lot	stoney gate valves	55,000.00	54,600.00	58,000.00
1	lot	gates operating machinery	15,000.00	14,700.00	14,000.00
Totals			$683,599.78	$733,324.55	$746,195.70



Location and section of second Twin City lock

Current Construction Unit Prices

Grading Village Creek at Birmingham

SECTION 3 of Village Creek drainage project at Birmingham, Ala., from west city limits to Roebuck Springs, was let Jan. 13, 1931, for $138,555. On this section the stream channel is to be enlarged and brought to grade, varying from El. 504 to 519, for a distance of some 9,200 ft. There are only three items in the work: 149,200 cu.yd. earth excavation, amounting to 43 per cent of the total cost; 6,500 cu.yd. rock, 56 per cent, and 700 sq.yd. riprap, less than 1 per cent of the total.

Eleven bids were received and average unit prices are given as well as those of the lowest three bidders: A, Ward Hayes Construction Co. (contract); B, Kershaw Construction Co.; C, R. C. Martin.

	A	B	C	Avg. 11
149,200 cu.yd. earth	$0.40	$0.34	$0.38	$0.44
6,500 cu.yd. rock	1.20	1.35	1.30	1.36
700 sq.yd. riprap	1.25	1.50	2.00	1.35
Totals	$138,555	$139,528	$142,596	$156,700

Dredging Between Manhattan Piers

DREDGING between North River piers 56 and 62, New York City, is being done by Henry DuBois' Sons Co., 17 State St., under contract let in January, 1931. Work includes removal of 286,000 cu.yd. of material other than solid rock, cribwork, old wrecks and hard material. It consists of mud, sand, shells, clay, gravel, ashes, loose stones, brick, old logs and piles. Hard material is determined by the depth to which a 1-in. gas pipe shod with a steel point can be pushed by one man. The contract is divided into two items: (1) slip between piers 56 and 57, quantity 63,000 cu.yd., and 25 calendar days for completion; (2) slips between piers 58, 59, 60, 61 and 62, quantity 223,000 cu.yd., and 95 days for completion. Depth is 40 ft. below m.l.w.

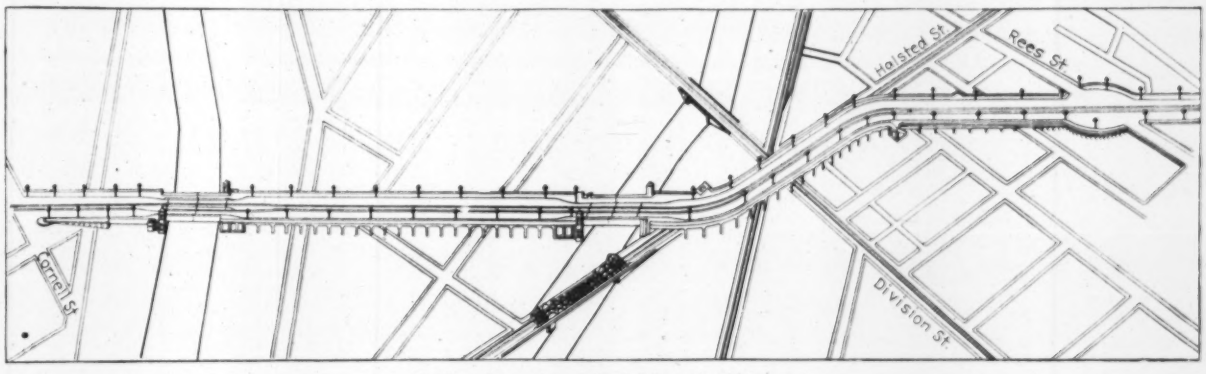
Contract price is 27½c. per cubic yard for both items. Two other bids were received: 28c. for both items, from Taylor & Pearson, Inc., Jersey City, N. J.; 32½c. for item 1, from Great Lakes Dredge & Dock Co., 17 Battery Pl. Work is under direction of the department of docks.

Elevated Highway for Chicago

OGDEN Ave. elevated highway from Cornell St. to Reese St., Chicago, is shown in the accompanying drawing. It includes: (1) a 2,961-ft. steel and reinforced-concrete viaduct 105 and 108 ft. wide and filled and paved approaches, with roadways and sidewalks; (2) two double-leaf bascule bridges, one 212 ft. long with two 28¾-ft. roadways and two 14½-ft. sidewalks over the North Branch of the Chicago River, and the other 244 ft. long with 60-ft. roadway and two 12-ft. sidewalks over the North Branch Canal. The two bridges are connected by a viaduct 108 ft. wide with 78-ft. roadway and two 15-ft. sidewalks.

Four bids were received Dec. 22, 1930, with a spread of 4 per cent between low and second, 7 per cent between low and third and 8 per cent between low and high. Unit prices are given of the lowest two: (A) Great Lakes Dredge & Dock Co., 104 South Michigan Ave. (contract); (B) Ketler-Elliott Co., 3001 South California Ave.

	A	B
11,500 cu.yd. common excav. for main br. piers	$5.00	$5.50
11,000 cu.yd. common excav. (not incl. cyl. sub-piers)	3.90	4.85
50 cu.yd. solid rock masonry disposed of outside main br. piers	10.00	25.75
75 cu.yd. solid rock or masonry disposed of side main br. piers	10.00	27.87
7,000 cu.ft. bolders over 15 cu.ft. removed from all cyl. piers	.50	1.17
1,500 cu.yd. dredging	.80	1.58
17,500 cu.yd. sand fill in place	2.50	1.90
156,000 cu.ft. 1:6 conc. in cyl. sub-piers except br. piers	1.99	3.30
77,000 cu.ft. 1:6 conc. in cyl. sub-piers under main br. piers	2.80	3.23
1,275 cu.yd. 1:6 conc. in cyl. sub-pier caps	20.00	35.47
7,325 cu.yd. 1:6 conc. in bridge piers	25.42	23.73
550 cu.yd. 1:6 conc. in inclosure walls	30.00	32.89
250 cu.yd. 1:6 conc. floor slabs mach. rooms	30.00	34.19
4,650 cu.yd. 1:8 conc. gravity retain walls and abut.	19.80	29.83
7,100 cu.yd. 1:6 conc. roadway sidewalks and slabs str. steel viaduct	37.92	35.51
8,750 cu.yd. 1:6 conc. and rein. via. incl. conc. stairs wheel-guards, vaulted sidewalks	39.44	37.63
30,100 sq.ft. conc. sidewalks on fill incl. cinder foundations	.40	.58
2,500 lin.ft. integral curb	1.25	1.50
18,000 sq.ft. damproofing ret. walls and abutments	.10	.40
5,600 lin.ft. precast conc. hand rail	17.50	25.70
485 cu.yd. armor coat	20.00	25.30
7,400 sq.yd. 10 in. conc. paving on fill	5.00	5.65
1,350 sq.yd. 8 in. conc. pavement on fill	4.50	4.80
500 sq.yd. asphalt pavement adjusted	6.00	5.75
104,000 sq.ft. cement mortar protection	.61½	1.10
19,950 sq.yd. 2 in. conc. wearing surface roadway	1.40	1.90
6,800 sq.yd. 1 in. conc. wearing surface on sidewalks	1.25	1.70
1,675 sq.yd. 1:5½ in. conc. wearing surface, fixed part of bridge roadway	2.20	2.20
50 cu.yd. 1:6 conc. footing, walls stair	25.00	29.60
780 ton 105 lb. conc. cwt.	15.00	15.55
960 ton 220 lb. conc. cwt.	29.00	30.30
120 ton 150 lb. conc. cwt.	14.50	21.45
2,180 ton 280 lb. conc. cwt.	34.30	27.40
20,000 lb. additional steel punchings	.04	.09
375 sq.yd. 1:4 conc. wearing surface sidewalk fixed part bridge	2.00	1.30
3,000 bag additional cement	.75	1.00
2,000 bag diff. ordinary cement and high-early-strength cement	.50	3.00
60,000 sq.ft. 2-ply waterproofing	.20	.50
18,000 sq.ft. metallic waterproofing	.30	.12
9,500 lin.ft. untreated piles delivered	.55	.52
8,000 lin.ft. untreated piles driven	.55	.85
5,700 lin.ft. creos. oak piles delivered	.75	.82
5,100 lin.ft. creos. oak piles driven	.80	1.00
13 M.b.ft. creos. oak timber in Br. piers	318.00	125.00
250 lin.ft. wood dock in place	98.80	105.50
9,000 sq.ft. ¾ in. asphalt plank sidewalks of bridges	.35	.22
19,800 sq.ft. 1½ in. asphalt plank roadway of bridges	.40	.45
43 M.b.ft. treated lumber for sidewalks of bridges	190.00	135.75
165 M.b.ft. treated lumber for roadways of bridges	185.00	127.40
4,600,000 lb. reinf. steel	.06	.06
7,800,000 lb. struc. cast steel in viad. incl. all exp. castings	.06 5/16	.05
6,100,000 lb. struc. and cast steel in bridges	.09 7/16	.08
48,000 lb. steel sheet piling in bridge pits	.15	.11
200,000 lb. miscellaneous iron	.15	1.09
250 lin.ft. 2 in. iron hand rail	12.00	15.55
200 lin.ft. 3 in. iron hand rail	10.00	10.75
700 lin.ft. alloy hand rail	30.00	33.75
1,025 lin.ft. safety treads	1.50	1.50
400 lin.ft. double extra strong 2 in. lead water pipe	5.00	2.75
250 cu.ft. asphaltic conc. caps	1.50	1.00
Totals	$4,349,669	$4,539,869



Ogden Ave. elevated highway in Chicago

Adjustable Stone Crusher

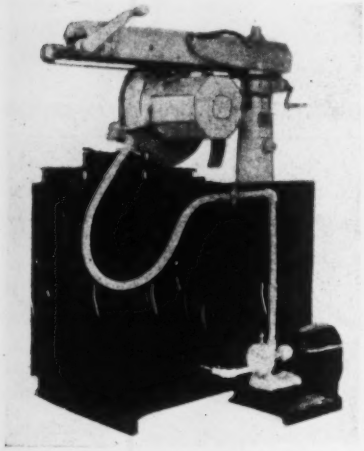
(Continued from page 629)

All bearings in the crusher are lubricated by a force-feed system equipped with pressure gage and automatic release valve. Oil is circulated by a self-priming internal gear pump, driven by cut spur gears. It is pumped into the bottom of the crusher and forced up on both inner and outer surfaces of the eccentric, then gathered in a circular trough that surrounds the eccentric housing and drained downward into the gear chamber by return pipes. Expanding piston ring seals are provided between the frame and the eccentric to prevent the entry of water and grit. From the gear chamber the oil flows back into a 30-gal. storage tank, where it is drained, cooled and settled for re-use.

Other construction features of the crusher include upper and lower frames of steel castings, guaranteed for two years against breakage; eccentric bearings of machined bronze running in an oil bath; and thrust roller bearings to take all vertical loads of crushing, and the use of a gyratory shaft without upper support or suspension bearing.

Brick and Tile Cutter

A demand for equipment to handle the cutting of brick and tile on the job has led the DeWalt Products Corp., Lancaster, Pa., to design a special unit for this work, applying the principle of direct drive power. Totally inclosed electric motors of either 4 or 8 hp. are used, operating at 1,750 r.p.m. Proper choice of cutting blades adapts this machine to either cutting through or scoring the hardest construction materials, including glazed or floor tile, common or glazed brick and natural or artificial stone. Easy adjustment of the machine makes possible accurate angular cuts. A tank with an automatic pump and motor is provided for use where a continuous water supply is not available. The entire machine can be mounted on a portable truck for easy handling.



Cutting wheel with self-contained water tank

Pneumatic Packing Cups

Composition packing cups for use in a wide variety of pneumatic devices are now being distributed by the Westinghouse Traction Brake Co., Wilmerding, Pa. The material used, bearing the trade name Wabco, is the same composition used for packing cups in air brake cylinders and is said to be superior in mechanical and physical properties to leather and other materials available for this purpose. Packing cups are available in sizes ranging from 1- to 26-in. diameter. The company also manufactures flat and beaded gaskets, valve seats and other products.

COSTS AND CONTRACTS

E. N.-R. Index Numbers

Cost			Volume		
Apr. 1,	1931	191.63	March,	1931	278
Mar. 1,	1931	194.51	February,	1931	198
Apr. 1,	1930	207.12	March,	1930	408
Average,	1930	202.85	Average,	1930	260
Average,	1929	207.02	Average,	1929	317
1913	.....	100.00	1913	.....	100

This Week's Contracts

Heavy construction contracts, reported by *Engineering News-Record* in the week of April 9, with some comparisons, total as follows:

(In Thousands of Dollars)

		Average of Last Four Weeks	
Buildings:	1931	1931	1930
Industrial	$7,638	$3,311	$11,532
Other	23,665	20,900	43,745
Streets and roads..	15,143	15,525	12,501
Other eng. constr..	17,094	37,113	41,994
Total	$63,540	$76,850	$109,774

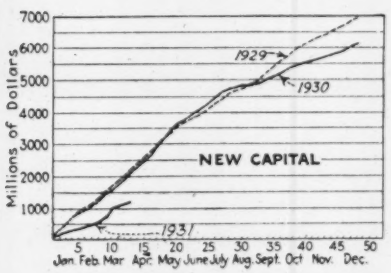
Total, all classes Jan. 1 to April 9:

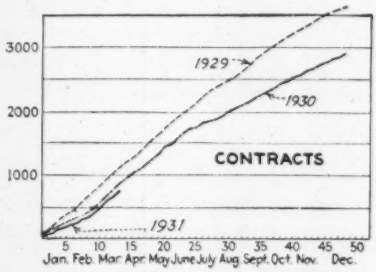
1931	$807,610
1930	987,129

Week's Contracts and New Capital

Contracts in the last week of March totaled 81 millions, compared with 46 the week before and 53 averaged for the year. The average for the month was 62 millions, compared with 98 in March, 1930, and 64 averaged in the first fourteen weeks of 1930.

New productive securities issued in the first week of April totaled 80 millions, compared with 141 the week before, 103 averaged in 1931 and 162 averaged in 1930. Largest issues of the week were $35,000,000 Northern States Power Co. 4½s and $10,000,000 North American Light & Power Co. 4½s and 5s.





Business Notes

PENNSYLVANIA-DIXIE CEMENT CORP., New York City, has appointed O. C. Hunt sales manager in charge of the territory served by its Des Moines (Iowa) plant. His headquarters will be in that city. R. J. Hild continues as district sales manager, and L. C. Currinder has been added to the company's staff at Des Moines.

CANTON CULVERT & SILO CO., Canton, Ohio, has changed its name to the Canton Culvert Co.

PARAFFINE COMPANIES, INC., San Francisco, Calif., has appointed as sales engineer E. A. Trafzer, formerly with the Celite Products Co. and the Johns-Manville Corp. in the Los Angeles district.

BUCYRUS-MONIGHAN CO. is the new name adopted by stockholders of the Monighan Mfg. Corp., Chicago, Ill., an action approved by the board of directors of the Bucyrus-Erie Co. The Bucyrus-Monighan Co. will operate as a separate organization except that sales will be handled by the organization of the parent company. New officers were elected by the Monighan company as follows: W. W. Coleman, chairman of the board; G. A. Morrison, vice-chairman. Officers reelected were: O. J. Martenson, president; W. T. Brennan, vice-president and treasurer; H. W. Voss, secretary.

EAGLE BRONZE WORKS INC., the Eastern division of the Eagle-Heath Bronze Corp., Mount Vernon, N. Y., has opened a general sales office at 103 Park Ave., New York City, under the supervision of William Lawson, sales manager.

EDWARD R. BACON CO., San Francisco, Calif., is now distributing products of the Lakewood Engineering Co., Columbus, Ohio; Lidgerwood Manufacturing Co., Elizabeth, N. J.; Midwest Locomotive Works, Hamilton, Ohio, and Ohio Locomotive Crane Co., Bucyrus, Ohio, in addition to lines of construction equipment previously handled.

WATER WORKS MANUFACTURERS ASSOCIATION, through its exhibit committee, is planning to award a prize to the manufacturer who has the most instructive exhibit at the annual convention of the American Water Works Association to be held in Pittsburgh, Pa., May 25-29. The award will be decided by a vote of A.W.W.A. members at the convention.

SHEPARD NILES CRANE & HOIST CORP., has placed Roy M. Hurst in charge of its Pittsburgh office, now located in the Grant Building. Frank J. Kinney will be associated with Mr. Hurst in this office. The Cleveland office, now at 1433 East Twelfth St., has been placed in charge of Harry A. Baugh, until recently in the Chicago office.

BAY CITY SHOVELS, INC., Bay City, Mich., has completed arrangements for the manufacture of its complete line in Canada by the John Inglis Co., Ltd., of Toronto. Sales of Bay City equipment in Canada will be continued through the present Canadian distributor under the supervision of the home office at Bay City, Mich.

PELTON WATER WHEEL CO., San Francisco, Calif., has appointed W. H. Holcomb general sales manager in charge of the sales and distribution of all company products. Mr. Holcomb was formerly manager of the pump department.

RACOR PACIFIC FROG & SWITCH CO., Los Angeles, Calif., has elected H. W. Renick president to succeed J. B. Strong, who is now vice-chairman of the board of directors. Mr. Renick was formerly vice-president of the company.

WESTERN BRIDGE CO., LTD., is preparing plans for the erection of a new plant costing approximately $500,000 at Vancouver, B. C.

CONSTRUCTION NEWS

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Some of the Week's Large Projects

For further details turn to the appropriate sections in this issue.

Location	*Project*	*Cost*	*Status*
Waterworks			
San Francisco	Pipe line	$7,250,000	Proposed
Lancaster (Pa.)	Dam, filtration plant, additions, etc.	3,250,000	Proposed
Bridges			
Suffolk County	Bridge	3,350,000	Proposed
Homestead (Pa.)	Bridge	3,000,000	Proposed
Railways			
Syracuse	Freight yards, etc.	3,713,000	Proposed
Pennsylvania	Steel, etc.	7,500,000	Contract
Federal Government			
Oakland (Calif.)	Post office, and custom house	1,500,000	Bids asked
Chicago	Post office	22,000,000	Bids asked
Rock Island	Locks	1,326,472	Contract
New York	Post office annex	5,000,000	Proposed
Stapleton (N.Y.)	Marine hospital	2,500,000	Proposed
Power Plants			
Winnipeg (Man.)	Steam plant ext.	1,000,000	Proposed
Warehouses			
Toronto	Terminal warehouse	2,000,000	Proposed
Buildings			
Worcester (Mass.)	Hospital	1,000,000	Proposed
New York	Hospital group	3,000,000 to 12,000,000	Proposed
San Francisco	Office	2,000,000	Proposed
Toronto (Ont.)	Office	1,000,000	Proposed
Toronto (Ont.)	Office	2,000,000	Proposed
Jersey City	Hall of Records	2,000,000	Proposed
White Plains (N.Y.)	County office	1,370,000	Contract
Reading (Pa.)	Court House	1,750,000	Proposed
Baton Rouge	University	1,000,000	Bids asked
San Francisco	Theatre	10,000,000	Proposed
Boston	Theatre	2,500,000	Proposed
San Francisco	War memorial, opera house, etc.	5,000,000	Bids asked
Worcester	Memorial	2,000,000	Proposed
Cincinnati	Auditorium, station	5,899,000	Contract

WATERWORKS

PROPOSED WORK

Calif., San Francisco—Bd. Supervs. soon takes bids 47.5 mi. 60 in. diam. pipe line to convey Hetch Hetchy water supply across San Joaquin Valley and Red River Mountain Bar siphon a connection between 2 sections of Foothill tunnels, bringing Hetch Hetchy water supply from eastern end Foothill tunnels to eastern portal Coast Range tunnel, now being driven. $7,250,000. Noted Apr. 2.

N. J., East Brunswick—Township Com., Twp. Hall, preliminary plane water works. $75,000 or more. R. Wilson, 46 Paterson St., New Brunswick, twp. engr.

N. J., Elizabeth—Bd. P. Wks., City Hall, preliminary plans water line in Galloping Hill Rd. $15,000. T. Collins, city engr.

N. J., Haledon—Bd. Boro Council, Boro Hall, new preliminary plans filtering plant at Haledon Reservoir. $120,000. A. T. Cook, 158 Ellison St., Paterson, archt. Noted Mar. 26.

N. J., West Paterson—Bd. Boro Council, Boro Hall, water line to furnish water to residents in Squirrelwood Rd. Sect. $15,000. **Maturity probably soon.** H. J. Harder, 129 Market St., Paterson, engr.

Pa., Lancaster—City Council new water impounding dam, additions to filtration plant, additional mains, 2 new sewage disposal plants, additional sewers. $3,250,000. J. N. Chester Engineers, Clark Bldg., Pittsburgh, engrs.

BIDS ASKED

Calif., Fresno—H. S. Foster, city clk., taking bids furnishing, installing 3 deep well turbine pumps in connection with municipal waterworks.

Calif., Glendale—City Council taking bids 2,000 g.p.m. horizintal centrifugal pump capable pumping against 320 ft. head; 2,600 g.p.m. horizontal centrifugal pump against 260 ft. heads, constructed for direct connection to 50 cycle motor; automatic starter and control equipment.

Calif., San Bernardino—Apr. 14, by City Council, 2,700 g.p.m. booster pump, 2,700 g.p.m. deep well turbine pump, deep well turbine with water wheel 675 g.p.m., all with direct connected motors.

Ind., Auburn—See "Power Plants."

Mass., Gosnold—See "Contracts Awarded."

Mass., Milton (br. Boston)—See "Contracts Awarded."

N. J., Paterson — Apr. 14, at office Passaic Valley Water Comn., 158 Ellison St., 705 ft. 24 in. steel pipe with threaded joints. A. T. Cook, genl. supt.; adv. E. N.-R. Apr. 9.

N. J., Pleasantville—See "Contracts Awarded."

N. Y., Brooklyn—Apr. 14, by J. J. Dietz, comr. Water Supply, Gas & Electricity, Municipal Bldg., New York, mains in Dewey Pl., Sheepshead Court, Farragut and Sheepshead Bay Rds., Avenues Q, T, X and Z, Albany, Elmwood, Kent, Ralph, Skillman, and Voorhies Aves., Ten Eyck, Wallabout, 86th, East 12th, East 13th, East 14th, East 49th, East 91st, and South 9th Sts.

N. Y., Dannemora—Apr. 21, by Dpt. Correction, W. N. Thayer, Jr., comr., State Office Bldg., Albany, water supply lines at Clinton Prison and Dannemora State Hospital, est. proposals (1) $61,257 (2) $56,757; adv. E. N.-R. Apr. 9.

N. Y., Long Island City—Apr. 14, by J. J. Dietz, comr. Water Supply, Gas & Electricity, Municipal Bldg., New York, mains in Newtown, 43rd, and 34th Rds., Flushing, 30th, 31st, 41st, 44th, 52nd and 75th, Ashby, Maple, 32nd and 45th Aves., 12th, 14th, 21st, 61st, 74th, 88th, 80th and 113th Sts.; constructing iron removal filters, steel tanks, pipe lines at Jamaica and Springfield Pumping Stations, driving, connecting 6 in. wells at Watts Pond Pumping Station, Nassau Co.

N. Y., New York—Apr. 14, by J. J. Dietz, comr. Water Supply, Gas & Electricity, Municipal Bldg., mains in Pelham Parkway North, Shore Dr., Polo and Twiggs Pls., Stadium, Vincent and Whitlock Aves., Croes, Fairfield, Fetley, Lacombe, Longstreet, Murdock, Nereid, Paulding, Radcliffe, Randall and Rosedale Sts., Bronx Boro.

N. Y., St. George—Apr. 10, by P. J. Dooling, comr. Purchase, Municipal Bldg., New York, delivering, unloading, stacking and storing c.i. pipe, valve box castings, valves, hydrant standpipes, hydrants, for Dpt. Water Supply, Gas & Electricity.

O., Youngstown—Bd. Control, bids about May 2, 16 in. main in southside sect. city, to traverse Williamson Ave. and Market St. Sect. $50,000; 3,700 ft. 24 in. main from Holmes St. and Arlington Ave. to Rayen St. and Walnut Ave., $60,000. W. H. Dittoe, Youngstown, engr. Noted Oct. 23.

R. I., Barrington—Bristol & Warren Waterworks Co., Barrington, bids after Apr. 15, (from selected list bidders), distribution system. Supervising Engineers, Inc., 42 Cedar St., New York, engrs. Noted Mar. 26.

Ont., Kitchener—See "Contracts Awarded."

Ont., Port Colborne — See "Contracts Awarded."

CONTRACTS AWARDED

Mass., Gosnold—Town, Bd. Selectmen, 100,000 gal. new concrete reservoir, Cuttyhunk Sect., day labor. C. R. Barnet, engr., Vineyard Haven, in charge. $10,000.

Mass., Milton (br. Boston)—Town, Bd. Selectmen, mains in various streets, day labor. Est. exceeds $15,000.

Mass., Yarmouth—Town, Water Comn., J. E. Howes, elevated tank for waterworks, to Pittsburgh-Des Moines Co., 50 Church St., New York; pumping station, to W. H. Barker, Cohannet St., Taunton; hydrants and valves, to Eddy Valve Co., Waterford, N. Y. Total est. $75,000. Noted Mar. 5.

Miss., Jackson—Mississippi Hospital Removal Comn., complete waterworks and sewage system for new buildings, to B. E. Walker Constr. Co., Jackson. $54,295.

Mo., Hollister—City, general contract waterworks, distribution system, to A. T. Hogle, Muskogee, Okla., $18,512; pumping equipment, to Forslund Pump & Mchry. Co., 3031 Main St., Kansas City, Mo., $2,150; steel storage tank to Darby Corp., 923 North 3rd St., Kansas City, Mo., $2,685. Grand total $23,347. Noted Feb. 5.

Mo., St. Louis—Water Dpt., L. Day, comr., City Hall, 24,000 ft. 6 in. c.i. pipe, to Amer. Cast Iron Pipe Co., 2930 North 16th St., Birmingham, Ala., at $0.60 per ft.; 8,000 ft. 8 in. c.i. pipe, to McWane Cast Iron Pipe Co., 3700 11th Ave. N., Chicago, Ill., $0.915; hub and spigot valves, to Chapman Valve Mfg. Co., 650 West Lake Dr., Chicago, Ill., $11,391; hub valves, to M. and H. Valve Co., Anniston, Ala., $8,600; 925 ft. 60 in. steel pipe, to Biggs Boiler Wks. Co., 1007 Bank St., Akron, O., $12,619.

N. J., Pleasantville—Bd. City Council, City Hall, wells to supply 575,000 g.p.d. near junction of New and Delilah Rds., supplying to Absecon, Northfield, Sommers Point, Linwood and Egg Harbor, separate contracts. $15,000. Noted Mar. 5.

O., Cincinnati—Comrs. Hamilton Co., constructing Water Supply Line 150, Schedule C, Springdale, incl. 58,338 ft. 6- to 12-in. c.i. pipe, to F. Haddad, 3032 West Blvd., Cleveland, $91,229, est. $115,808—Water Supply Line 150, Schedule B, Sharonville, 41,277 ft. 6- to 12-in. c.i. pipe and Water Supply Line 150, Schedule A, 38,973 ft. 6- to 12-in. c.i. pipe, to J. G. Meier, Norwood, $84,404 and $54,698 respectively, est. $112,198 and $64,712 respectively. Grand total $230,331. Noted Mar. 30 Daily.

O., Youngstown—City, furnishing 160 tons 6- to 30-in. c.i. pipe, fittings for waterworks improvements, to James B. Clow & Sons, North Talman and West Lake Dr., Chicago, Ill., $106,304. Est. $100,000. Noted Oct. 23.

Tex., Highlands—See "Sewers."

Tex., Kilgore—City, c/o R. H. Laird, comr. complete waterworks and sewage systems, to W. G. Davis Constr. Co., North Texas Bank Bldg., Dallas. Noted Mar. 19.

Ont., Kitchener—City, 1 mi. 12 in. c.i. main, day labor. $15,000. S. Shupe, City Hall, engr.

Ont., Port Colborne—Town, 6 in. and up c.i. mains in various streets, day labor. $51,500. G. M. Hamilton, Port Colborne, engr.

See proposal advertising on page 176

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LEADITE

PRICE PER POUND
versus
PER MILE COST OF CONSTRUCTION

You know that the main saving in making joints in bell and spigot water pipe is in making them with a material which requires caulking, and a material which does not require caulking.

But,—the saving between two self-caulking jointing materials is very slight, even with several cents per pound difference in price, when spread over the per foot, or per mile, cost of construction, of the pipe line.

From a "sales point," the difference in price per pound between two self-caulking jointing materials may at first sound attractive to the prospective purchaser, but the actual difference in cost on a mile of pipe does *not* appear so convincing when you consider the entire investment of the pipe line installed,—especially, when you are putting the pipe under ground as a "permanent installation."

The difference in price per pound between LEADITE (which is the pioneer self-caulking jointing material for bell and spigot water mains) and other self-caulking jointing materials, would probably not even affect the proposal price on a pipe line job. The Principals would probably have to pay the same price for the installation, whether it were laid with LEADITE, or with a lower priced self-caulking material.

The extensive use and long excellent performance record, of a product, (such as LEADITE) are features which most water works men consider in selecting any material to be used by them on such important work as a water pipe line.

Buried to be forgotten, as water mains usually are, it takes a long time to convince or persuade water works men to allow their field work to be used as an "experimental laboratory" for any product that may come along, even though represented to be "JUST AS GOOD."

Water works men *know*, that they can buy almost anything represented to be "JUST AS GOOD,"—and usually at a lower price. They also *know*, that *quality counts*, and are usually willing to pay for it.

On one mile of six (6") inch pipe, 440 joints, (12 foot lengths), the approximate difference in cost of one self-caulking jointing material over another would be as follows:

	Per Mile
1c. per lb. lower price would amount to	$ 13.20
2c. per lb. lower price would amount to	26.40
3c. per lb. lower price would amount to	39.60
4c. per lb. lower price would amount to	52.80
5c. per lb. lower price would amount to	66.00
6c. per lb. lower price would amount to	79.20
7c. per lb. lower price would amount to	92.40
8c. per lb. lower price would amount to	105.60

The foregoing might not be thought of when discussing price per pound, but it will be seen from the above figures, that the difference is slight. *Probably less than 1% of the entire investment in the line.*

Water works men are known for the care they exercise in selecting materials,—and it seems that they still prefer to use long tried and tested materials, rather than some "cheaper" products which might not have the same long performance record back of them.

LEADITE is the most widely known, the most frequently discussed, the most often specified and the most extensively used self-caulking jointing material for bell and spigot water mains.

The Pioneer self-caulking material for c. i. pipe.
Tested and used for over 30 years.
Saves at least 75%

THE LEADITE COMPANY
Land Title Building Philadelphia, Pa.

No Caulking

SEWERS

PROPOSED WORK

Ind., Ft. Wayne—Bd. P. Wks. Northeast Sanitary Sewer, incl. 4 mi. 12- to 84-in. pipe. $550,000. V. A. Barnett, 3222 Robinwood St., engr.

Mass., Brookline (br. Boston)—Town, sewers, drainage, concrete sidewalks and some bridge work various streets. $200,000 appropriated. H. A. Varney, Town Hall, engr.

N. J., Jersey City—Bd. City Comrs., City Hall, sewer, gas and watermains and connections, providing for conduits for electric wires, relocating trolley tracks, removing overhead wires, curbing, sidewalks, paving Duncan Ave., between Wilmot Ave. and Gate Hy. $25,000. J. Henderson, city engr.

N. J., Little Falls—Township Com., Municipal Bldg., extending and enlarging sewage disposal plant, sewage. $123,000. **Maturity probably soon.**

Pa., Lancaster—See "Waterworks."

Ont., Hamilton—For 8 in. and up vitr. tile storm and sanitary sewers in Sussex St., Broadway, Emerson, Holmes, Royal, Ward and Whitney Aves. $175,990. W. L. McFaul, City Hall, engr.

Ont., Toronto—York Twp. soon takes bids 4,650 lf. 8 in. and up vitr. tile sewers in Eglinton and Glen Cedar Ave. $27,230. T. S. Scott, 40 Jarvis St., engr.

Ont., Toronto—For 3/4 mi. concrete, brick or concrete trunk sewer, partly tunnel in Park Dr. from Glen Rd. to Don River. $144,410. R. C. Harris, City Hall, engr.

BIDS ASKED

Calif., Gonzales—Apr. 17, by Bd. Trustees Gonzales Sanitary Dist., 8- to 12-in. sewers, outfall and separate sludge digestion plant. To exceed $25,000. Burns-McDonnell-Smith Eng. Co., Western-Pacific Bldg., Los Angeles, engrs.

Ill., Chicago—Apr. 23, by J. J. Sullivan, clk., Sanitary Dist. of Chicago, 910 South Michigan Ave., Calumet Sewage Treatment Works Extension Divs. A, B and E. R. A. Woodhull, chn.; adv. E. N.-R. Apr. 9.

Mass., Boston—Apr. 15, by Dpt. P. Wks., sewerage works in West Roxbury. $25,000. J. A. Rourke, comr. Dpt. P. Wks.

Mass., Boston—Apr. 17, by Dpt. P. Wks., sewerage works in Foster St., Brighton. $25,000. J. A. Rourke, comr.

New York—Apr. 17, by Westchester Sanitary Sewer Comn., E. S. Martin, secy., Court House Annex, White Plains, Sects. C and D, Sawmill Project, in Village of Pleasantville and Town of Mount Pleasant; adv. E. N-R. Apr. 9.

N. Y., Brooklyn—Apr. 15, by H. Hesterberg, pres. Brooklyn Boro, Boro Hall, sewers in Schenectady, Troy and Utica Aves., Clarendon, Beverly and Cortelyou Rds., Coyle, East 39th, East 42nd, East 46th, East 48th Sts.

N. Y., St. George—Apr. 15, by J. A. Lynch, pres. Richmond Boro, temporary sanitary sewers in Ontario Ave., from Victory Blvd. to Little Clove Rd.

Pa., East McKeesport (McKeesport P. O.)—See "Contracts Awarded."

Pa., Etna—Apr. 20, by Boro, J. C. Armstrong, secy., 23 Locust St., trunk sewer from Allegheny River along Pine Creek to northerly line of Shaler Twp. $100,000. Former bids rejected. S. H. Burns, 215 Williams St., Millvale, engr. Noted Feb. 26.

Va., Richmond—Apr. 10, by Dpt. P. Wks., City Hall, R. K. Compton, dir., 10 ft. inside diam. concrete sewer in west end in connection with Sheppard Street Relief Sewer. $150,000.

CONTRACTS AWARDED

Calif., Los Angeles—Bd. P. Wks., City Hall, San Pedro Intercepting Sewer, Sect. 2, incl. 6,335 lin.ft. pre-cast rein.-con. pipe, to H. E. Warden, 2401 South Orange Dr., $89,900.

Miss., Jackson—See "Waterworks."

N. J., Manasquan—Bd. City Council, Bordon Bldg., ventilating system at sewage disposal plant, to Kuchar Bros., Montvale. Est. $25,000.

N. Y., Brooklyn—H. Hesterberg, pres. Brooklyn Boro, Boro Hall, to V. Samoni & DiNapoli, 723 Glenmore Ave., sewer in Delamere Pl. $6,614; East 57th St. $1,691; East 43rd St. $1,317; to A. Paino Constr. Co., 2916 East 14th St., Aves. X and Y $129,284—to M. Mornara, 216 1st Ave., sewer in East 96th St., $2,062—to E. Meluccio, 1209 6st St., East 53rd St., $3,297. Grand total $144,265. Noted Mar. 12.

N. Y., Long Island City—G. U. Harvey, pres. Queens Boro, Queens Subway Bldg., to Kennedy & Smith, Inc., Bradford Ave., Flushing, sewers in Fisk Ave., $10,474; to P. Ambrosio, 674 Glenmore Ave., Brooklyn, in Harrow St. $6,020, 115th Ave. $14,118, 194th St.; $1,179; to Welsh Bros. Contg. Co., 27 Purvis St., Merrick Rd. $24,628, Beach 32nd St. $13,556. Grand total $69,975. Noted Mar. 19.

N. Y., Tonawanda—For 1 mi. 32- to 54-in. storm drain in Gibson St., to Hackett, Leason & Carnes Co., Tonawanda, $44,333.

O., East Columbus—For 25,900 ft., 8 in. and 5,470 ft. 10 in. vitr. sanitary sewer in Sanitary Sewer Dist. 2, tentatively awarded to East Columbus Coal & Supply Co., East Columbus. Matter is in litigation in Ohio Supreme Court as to validity of certain bond issues.

Pa., East McKeesport (McKeesport P.O.)—Boro, R. C. Beswick, secy., 514 Chicora St., 1 mi. terra cotta sewer, on Northerly line Turtle Creek, owner builds, local labor. R. M. Douglass, Columbia Bank Bldg., Pittsburgh, engr.

Tex., Highlands — Sanitary sewerage and waterworks systems, to Harper Constr. Co., Dallas, $103,500.

Ont., Niagara Falls—For 1 mi. 8 in. and up vitr. tile storm sewers in Bender Ave., Culp St. and Drummond Rd., day labor. $25,000. W. S. Orr, engr.

WASTE DISPOSAL

PROPOSED WORK

Mass., Brockton—City, W. S. Bamford, City Hall, incinerator. $50,000 or more.

Pa., North Belle Vernon—Boro, L. H. Hixenbaugh, secy., Belle Vernon, incinerator. Architect not selected.

BRIDGES

PROPOSED WORK

New Jersey—Joint Bd. Comrs., Asbury Park and Ocean Grove, City Hall, Asbury Park, revised preliminary plans 2 steel, concrete bridges over Wesley Lake, one at Emery St., other at Hick Ave., between Asbury Park and Ocean Grove. $70,000. M. Rogers, 418 Monmouth Ave., Bradley Beach, engr. Noted Mar. 12.

N. Y., Shelter Island and Brookhaven—Suffolk Co., Riverhead, bids in May substructures for bridges connecting Shelter Island with mainland, on north and south sides of Island; bridge, approaches from mainland to Ocean Beach, at Smith's Point in Brookhaven. $3,350,000. Robinson & Steinman, 117 Liberty St., New York, engrs.

Ont., Hamilton—Soon takes bids 360 ft. steel span high level bridge, concrete piers, abutments, concrete flooring, railings. $300,000. James, Proctor & Redfern, 36 Toronto St., Toronto, engrs.

Ont., Sandwich—Essex Co., rein.-con. culvert, bridge. $25,000 up. J. J. Newman, Davis Bldg., Windsor, engr.

Quebec—Provincial Dpt. P. Wks., Quebec City, soon takes bids steel bridge over St. Francis River between St. Francis du Lac and Pierreville, $400,000—steel, concrete bridge over St. Lawrence River between Islands of Orleans and Beaupre Shore, $600,000—steel, concrete bridge over Richelieu River between Beloeil and St. Hilaire, $400,000—steel, concrete bridge over Richelieu River between Sorel and St. Joseph de Sorel, $400,000—steel bridge over Yamaska River between East and West Yamaska, $400,000—steel, concrete bridge over Saguenay River between Ste. Anne and Chicoutimi, $500,000—steel bridge between Lasalle and Caughnauga, $800,000.

BIDS ASKED

Calif., Santa Barbara — Bd. Supervs. Santa Barbara Co. taking bids rein.-con., steel bridge over San Roqui Creek on Goleta Foothill Blvd. To exceed $45,000.

Illinois—Apr. 14, by State Dpt. Pub. Wks. & Buildings, Div. Hys., Springfield, three 54 ft. span rein.-con. arch bridge, Route 5, Sect. 2YB Cook Co.—one 60 ft. span rein.-con. girder bridge, Route 11, Sect. 28X-B Madison Co.—five 50 ft., two 30 ft., one 45 ft. and three 60 ft. span, rein.-con. girder bridge, one 16 ft., two 20 ft. and one 30 ft. span rein.-con. slab bridge, Route 48, Sect. 125B-Macon, DeWitt and Piatt Counties—one 250 ft. steel truss span, two 60 ft. rein.-con. girder span bridge Route 49, Sect. 146-B-2 Cook Co.—one 20 ft. span rein.-con. slab bridge, one 24 ft. span rein.-con. girder bridge, one 34 ft. rein.-con. substructure, Route 82, Sect. 129-B—one 160 ft. span steel superstructure, relocating existing steel truss bridges, Route 82, Sect. 129-C, both Henry Co.—one 30 ft. span rein.-con. girder bridge on rein.-con. substructure, Route 88, Sect. 103-B—one 120 ft. steel superstructure, Route 88, Sect. 103-C—one 30 ft. rein.-con. slab span, one 20 ft. rein.-con. girder span, two 45 ft. span rein.-con. substructure, Route 88, Sect. 104-B—one 125 ft steel superstructure, Route 88, Sect. 104C, all Bureau Co.—six 50 ft. span rein.-con. girder bridge, rein-con. substructure, Route 97, Sect. 142-B—three 100 ft. span steel superstructure, Route 97, Sect. 142-C, both Fulton Co.—six 50 ft. I-beam bridge, rein.-con. substructure, Route 121, Sect. 111-B—one 115 ft. span steel superstructure, Route 121, Sect. 111-C, both Logan Co.—four 30 ft. rein.-con. girder spans, two 40 ft. rein.-con. slab spans, one 24 ft. rein.con. box culvert, rein.-con. substructure, Route 130, Sect. 112-B—one 128 ft. span steel superstructure, Route 130, 112-C—five 56 ft. span rein.-con. girder bridge, Route 130, Sect. 113-B, all Cumberland Co.—three 50 ft. and one 55 ft. span rein.-con. girder bridge, one rein.-con. box culvert, Route 147, Sect. 113-B Williamson Co. —two 40 ft. span rein.-con. girder bridge, rein.-con. substructure, Route 151, Sect. 115-B—two 160 ft. span steel superstructure, Route 151, Sect. 115-C both Jackson Co. F. T. Sheets, hy. engr.

Indiana—Apr. 15, State Hy. Comn., Indianapolis, 84 ft. plate girder bridge over Burns Ditch near Lake, Contr. 400-20-A-109 Porter Co.— 30 ft. rein.-con. arch bridge over Deer Creek near State Rd. 9, Contr. 401-22-J-1075 Grant Co.—150 ft. steel truss bridge over Hoagland Ditch near Wolcott, Contr. 402-24-D-911—32 ft. rein.-con. girder bridge over Honey Creek, Contr. 403-24-D-912 — 40 ft. rein.-con. girder bridge over Warda Ditch, Contr. 403-24-D-913 near Reynolds, all White Co.—one 50 ft. and two 46 ft. span rein.-con. arch bridge over Little Raccoon Creek, Contr. 404-36-A-587—one 39 ft., one 24 ft. and three 36 ft. span rein.-con. girder Bridge, also grading 0.25 mi. approaches over Baltimore & Ohio R.R., Contr. 36-A-993, both near Montezuma, Vermillion Co.—72 ft. steel truss bridge over Brown Ditch, Contr. 405-41-U-1114—84 ft. steel truss bridge over Singleton Ditch, Contr. 405-41-U-1115, both near Schneider Lake C.—48 ft. steel truss bridge over Owl Creek near Brick Chapel, Contr. 406-43-F-1084 Putnam Co.—84 ft. steel bridge over Offield Creek, Contr. 406-43-H-1090—24 ft. rein.-con. girder extension over drain ditch, Cont 406-43-H-281-A—40 ft. rein.-con. arch bridge over Rattle Snake Drain, Contr. 407-43-H-1088 —30 ft. rein.-con. arch underfill over Dry Branch, Contr. 407-43-H-1096, all near Crawfordsville, Montgomery Co.—16 ft. rein.-con slab bridge over Lucas Ditch, Contr. 408-52-L 1180 near Lebanon, Boone Co.—80 ft. rein.-con arch bridge over Clifty Creek, near Madison, Jefferson Co.—49 ft. rein.-con. girder bridge on State Rd. 20, Contr. 410-212-A-1024, near Michigan Coty, Laporte Co. J. J. Brown, dir. State Hy. Comn. will furnish fabricated structural steel superstructure for bridge over Hoagland Ditch near Wolcott.

Iowa—Apr. 14, by State Hy. Comn., Ames, three 11 x 16 ft. and one 11 x 20 ft. wood bridges, raising 100 x 20 ft. truss bridge, also 20 culverts, extensions, Rd. 18, B-259 Clay Co. —90 x 20 ft. pony truss bridge with two 40 x 20 ft. I-beam approaches, 1 culvert extension, Rd. 169 north of Winterset, B-36, Madison Co. —36 x 24 ft. and two 32 x 24 ft. I-beam spans, one 90 x 20 ft. skew pony truss span with two 40 x 20 ft. I-beam approaches, one 20 x 24 ft. I-beam and one 40 x 24 ft. I-beam spans, raising 36 x 18 ft. concrete girder bridge, also 38 culverts extensions, Rd. 9, from Sibley north and east, B-725 Osceola Co.—40 x 24 ft. I-beam bridge, raising 40 x 24 ft. I-beam bridge, also 31 culverts, extensions, Rd. 9 from Kossuth Co. Line east and from Forest City north, B-750-AC Winnebago Co. C. R. Jones, and.

Kansas—See "Streets and Roads."

Kentucky—See "Streets and Roads."

Mass., Boston—Apr. 22, by Dpt. P. Wks., J. A. Rourke, comr., rebuilding concrete, steel bridge over Midland Div. New York, New Haven & Hartford R.R., Morton St. $60,000 bond. Noted Jan. 15.

New Jersey—Apr. 20, by State Hy. Comn. State Office Bldg., Trenton, bridge to carry Route S1, Sect. 1 over Route 5, Fort Lee, Bergen Co. A. L. Grover, ch. clk.; adv. E. N.-R. Apr. 9.

N. Y., Yonkers—Apr. 23, by C. MacDonald, engr. Westchester Co., Court House, White Plains, widening, reconstructing 3 span masonry bridge on McLean Ave. over Tibbetts Brook Valley; adv. E. N.-R. Apr. 9.

Ohio—Apr. 11, by O. W. Merrell, dir. hys., Columbus, 3 span, 135 ft., concrete beam bridge, 36 ft. roadway, Cleveland, Medina Rd., Medina Co., $49,913.

O., Columbus—Apr. 29, by Comrs. Franklin Co., F. L. Donnally, clk., 7 span rein.-con. bridge, $252,500. C. C. Lattimer, Court House, engr.

R. I., Providence—Apr. 20, by Bd. Contr. & Supply, steel superstructure for bridge, Eagle St. and Quinsley Ave. $25,000. S. F. Nolan, City Hall, engr. Noted Jan. 22.

Utah — Apr. 13, by State Rd. Comn., Salt Lake City, two I-beam bridges on concrete piers, on hy. between Moab and Lasal Junction, Grand and San Juan Counties. H. S. Keff, state hy. engr.

Virginia—See "Streets and Roads."

Wisconsin—See "Streets and Roads."

Ont., Niagara Falls—See "Contracts Awarded."

Ont., Sarnia—City, Province of Ontario and Canadian Natl. Rys., bids about Apr. 15, 5 span, 252 ft. bridge, concrete abutments, piers, floors over St. Clair Tunnel cut, on Vidal St. $40,000 —$50,000. W. B. Beatty, city engr. Noted Oct. 16, under "Contracts Awarded."

CONTRACTS AWARDED

Calif., Oakdale—Stanislaus Co., Modesto, 390 ft. rein.-con. bridge, 24 ft. wide with 20 ft. roadway over Stanislaus River, north of here, to Bodenhamer Constr. Co., 354 Hobart St., Oakland, $54,000. Noted Mar. 19.

Ill., Chicago—Bd. Comrs. Cook Co., County Bldg., Southwest Hy. Bridge over Sag Channel, to L. B. Fugitt Constr. Co., 307 North Michigan Ave. $122,779.

Iowa—State Hy. Comn., Ames, 1 bridge, 34 culverts, extensions, Allamakee Co., and culverts, extensions, Boone Co., to C. R. Yegg, Boome, $26,465 and $739 respectively—26 culverts, extensions, Allamakee Co., to J. Beede, Waukon, $9,170—17 culverts, extensions, Allamakee Co., to T. Fisko, Garber, $2,890—18 culverts, extensions, Black Hawk Co., to E. B. Spencer Constr. Co., Waterloo, $4,640—2 plate girder bridges, B-748 and 2 plate girder bridges, approaches F.A.B. 147 Clinton Co., to Snyder & Johnson, Humboldt, $18,361 and $51,254 respectively—plate girder bridge, building approaches, Dubuque Co., to A. Melberg, Cedar Rapids, $58,416—steel truss bridge, approaches, raising and widening slab bridges, building, 39 culverts, extensions, B-543 and I-beam Bridge X-836, Washington Co., to Iowa Bridge Co., 19th St. and Eastern Blvd., Des Moines, $33,011 and $9,982 respectively. Grand total $214,928. Noted Mar. 26.

New Jersey and Pennsylvania—Joint Comn. for Elimination of Toll Bridges over Delaware River, State Bldg., Trenton, steel bridge between Uhlertown, Bucks Co., Pa. and Frenchtown, Hunterdon Co., N. J., to F. H. Clement Co., Bethlehem, Pa., $89,000. Noted Feb. 5.

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Bridges (Continued)

New Jersey — State Hy. Comn., Trenton, 3 bridges, Atlantic Co., to Eastern Eng. Co., 4 North Carolina Ave., Atlantic City, $947,996. Noted Mar. 19.

N. J., New Brunswick—Pennsylvania R.R. Co., T. J. Skillman, ch. engr., Broad St. Sta., Phila., Pa., reconstructing 2 steel encased bridges over George and French Sts., to Brann & Stuart, Commercial Trust Bldg., Phila., Pa. Est. $25,000.

N. Y., Long Island City—G. U. Harvey, pres. Queens Boro, Queens Subway Bldg., bridge to carry Sunrise Hy. over Rockaway Blvd., to Tully & DiNapoli, 30-11 Sherman St., Astoria, $192,132. Noted Mar. 5.

North Carolina—State Hy. Comn., Raleigh, **(P. means Project)**, rein.-con. bridges, culverts on P. 7960 Yadkin Co., to E. A. Wood & Co., Andrews, $162,874—rein.-con. bridges, culverts on P. 7961, same county, to Hobbs-Peabody Constr. Co., Charlotte, $29,423—P. 1643, Nash Co., to Kiker & Yount, Reidsville, $36,918—P. 1630, Nash Co., to J. S. Bowers, Whiteville, $30,075. Grand total $259,290. Noted Mar. 5.

Texas—G. Gilchrist, state hy. engr., Austin, **(F.A.P. means Federal Aid Project)**, 2 rein.-con. deck girder bridges, approaches on Hy. 99, State Project 903-I, Upton Co., to Municipal Eng. Co., Athletic Bldg., Dallas, $28,872 est. $30,000—2 rein.-con., steel I-beam stringer bridges, concrete floor slabs, treated timber pile bridges on Hy. 18, F.A.P. 446 C, Motley Co., to W. W. Vann & Co., Mercedes, $40,722 est. $50,000—rein.-con. bridges on Hy. 5, F.A.P. 549-D, Cooke Co., to L. D. Parks, Fort Worth, $33,913, est. $46,000—steel, concrete, timber pile bridges on Hy. 21, F.A.P. 620-A, Brazos Co., to J. F. Buckner, 407 North Main St., Cleburne, $18,332 est. $30,000—2 rein.-con. bridges, approaches Hy. 9, F.A.P. 626-B, Concho Co., to Crouch & Noland, Strawn, $28,-961 est. $30,000. Grand total $150,800. Noted Mar. 26.

Tex., Fort Worth — Tarrant Co., Albright Bridge, 200 ft. long, 20 ft. wide, steel, concrete over Trinity River, 1st St., to Austin Bridge Co., 1813 Clarence St., $22,000. Noted Feb. 12.

Virginia—See "Streets and Roads."

Wisconsin—State Hy. Comn., Milwaukee, Giblin Bridge, Sauk Co., to Wausau Iron Wks., Wausau, $22,454—Narrows Bridge, Sauk Co., to Eau Claire Eng. Co., Eau Claire, $18,051—Beth Bridge, Sauk Co., to Alfred Brown & Co., Chippewa Falls, $18,057 — grading 6.668 mi. Portage-Endeavor Rd., Columbia Co., to Nelson, Mullen & Nelson, 355 Gateway Bldg., Minneapolis, Minn., $74,497—7.366 mi. Port-Washington-Fox Lake Rd., Dodge Co., to M. Wunderlich, 734 Snell Ave. N., St. Paul, Minn., $109,-874. Grand total $242,933. Noted Mar. 19.

Ontario—A. A. Smith, deputy minister Dpt. Hys., Parliament Bldg., Toronto, bridge over Fairchild Creek, east of Cainsville, Contr. 31-25, to W. G. Campbell, 142 Geoffrey St., Toronto. L'Original overhead bridge, Contr. 31-26, to Z. Brunet & Son, 193 Main St., Hull, Que.—Kincardine Bridge, Contr. 31-27, to Keys Bros., Kincardine—bridge St. Ann, incl. diversion grading, Contr. 31-28, to A. Cope & Son, 19 Albert St., Hamilton—Greenwood Bridge, Contr. 31-29, to Wm. Birmingham & Son, 184 Wellington St., Kingston—bridge west of Kerwood, Contr. 31-30, to Waltham & Fuller, Kerwood, all foregoing of concrete and reinforced construction for piers and abutments, concrete spans, structural steel spans, concrete floorings. Est. $150,000-$200,000. Noted Feb. 5, under "Streets and Roads."

STREETS AND ROADS

BIDS ASKED

Calif., Santa Rosa—Apr. 15, by G. P. Sanborn, clk. Sonoma Co., 1,020 bbl. light oil, 110 tons heavy oil, 2,550 tons rock, 1,700 tons screenings on 17 mi. roads in 5th Supervisorial Dist.—444 bbl. light oil, 148 tons heavy oil, 1,110 tons rock, 750 tons screenings on 7.4 mi. 2nd Supervisorial Dist.—480 bbl. light oil, 140 tons heavy oil, 1,750 tons rock screenings 6.9 mi. 4th Supervisorial Dist.—1,870 bbl. light oil, 640 tons heavy oil, 4,755 tons rock, 3,170 tons screenings 31.7 mi. 3rd Supervisorial Dist. E. P. Peugh, Santa Rosa, co. surv.

Calif., South Pasadena—Apr. 15, by City Directors, improving Huntington Dr., incl. 1,200 tons asphaltic concrete base, 432 tons asphaltic concrete top surface, culverts, catchbasins.

Colorado—Apr. 14, by State Hy. Dpt., Denver, grading, gravel surfacing 4.243 mi. state hy. west from Fruita, Federal Aid Project 242-E, Mesa Co.—gravel surfacing 9.78 mi. State Hy. 8 east of Peoria, State Aid Project 149-G, Arapahoe Co. C. D. Vail, hy. engr.

Conn., Hartford—Apr. 14, by Bd. Contr. & Supply, J. S. Bush, secy., sheet asphalt cement base paving 51,230 sq.yd. Asylum, Belden, Broad, Hicks, Hudson, Jefferson and Woodland Sts., asphalt patching 35,000 sq.yd. various sections. To exceed $25,000. N. N. Clark, city engr.

Idaho—Apr. 14, at office A. Harbour, comr. P. Wks., Boise, grading, draining, crushed rock surfacing 7,600 cu.yd. Palouse Hy. between Mud Bay and Setters, Kootenai Co.

Illinois—Apr. 14, by State Dpt. P. Wks. & Buildings, Div. Hys., Springfield, concrete, bituminous filled brick on concrete or bituminous concrete (fine or coarse aggregated type) on concrete surfacing 1.24 mi. Route 4, Sect. M-Y —4.14 mi. Route 4, Sect. 28Y—0.12 mi. Route 49, Sect. 142X-1—0.16 mi. Route 49, Sect. 143Y-X, all Will Co.—8.8 mi. Route 4, Sect. 29Y, Will and DuPage Counties—5.05 mi. Route 4, Sect. 430Y-1, Cook and DuPage Counties—0.48 mi. Route 6, Sect. CR-1, DuPage Co.—0.37 mi. Route 6, Sect. P-1 0.6 mi. Route 18, Sect. 7, both Cook Co.—12.93 mi. Route 48, Sect. 125, Macon, DeWitt and Piatt Counties—10.5 mi. Route 48, Sect. 126—0.72 mi. Route 48, Sect. 128X, both Macon Co.—6.19 mi. Route 59, Sect. 110, DuPage and Cook Counties—2.15 mi. Route 59, Sect. 111, DuPage Co.—7 mi. Route 66, Sect. 652, Kendall, Kane and DuPage Counties—3.38 mi. Route 69, Sect. 124, LaSalle Co. —15.06 mi. Route 82, Sect. 120 Henry Co.—0.97 mi. Route 90, Sect. 107, Marshall Co.—5.06 mi. Route 92, Sect. 158 Bureau Co.—8.05 mi. Route 109, Sect. 101, Jersey Co.—1.63 mi. Route 120, Sect. 111, DeWitt Co.—0.3 mi. Route 121, Sect. 139X, Macon Co.—0.19 mi. Route 121, Sect. 148X—0.41 mi. Route 121, Sect. 149X—0.5 mi. Route 121, Sect. 150X, all Edgar Co.—4.23 mi. Route 130, Sect. 113, Cumberland Co.—0.39 mi. Route 132, Sect. 101X, Macon Co.—0.8 mi. Route 146, Sect. 102X Union Co.—5.36 mi. Route 161, Sect. 113, Perry and Jackson Counties—6 mi. Route 151, Sect. 114—3.78 mi. Route 151, Sect. 115, both Jackson Co.—1.1 mi. Route 157, Sect. 118—5.6 mi. Route 157, Sect. 121, both St. Clair Co. —grading, drainage structures 0.65 mi. Route 21, Sect. 5X-A, Lake Co.—4.08 mi. Route 88, Sect. 103-A, 7.79 mi. Route 88, Sect. 104-A, both Bureau Co.—7.68 mi. Route 97, Sect. 142-AA, Knox and Fulton Counties—1.07 mi. Route 121, Sect. 111-A, Logan Co.—8.82 mi. Route 130, Sect. 112-A, Cumberland Co.—11.55 mi. Route 121, Sect. 111-A, Logan Co.—8.82 mi. Route 130, Sect. 112-A, Cumberland Co.—11.55 mi. Route 147, Sect. 113-A, Williamson and Johnson Counties. F. T. Sheets, hy. engr.

Ill., Monmouth—Apr. 15, by State Dpt. P. Wks. and Buildings, Div. Hys., Springfield, gravel surfacing 0.244 mi. Sect. 2-M.F.T., 12 ft.—2.014 mi. Sect. 4-M.F.T., 12 ft.—2.0237 mi. Sect. 6-M.F.T., 30 ft., all Monmouth Co. G. H. Baker, engr. co. roads.

Ill., Morrison—Apr. 16, by State Dpt. P. Wks. & Buildings, Div. Hys., Springfield, concrete surfacing 1.1742 mi. Sect. K-M.F.T., 10 and 18 ft. —2.4527 mi. Sect. K2-M.F.T., 10 and 18 ft.—bridges on Sect. KB-M.F.T., all Whiteside Co. G. H. Baker, engr. co. roads.

Ill., Mt. Carroll—Apr. 17, by State Dpt. P. Wks. & Buildings, Div. Hys., Springfield, gravel surfacing 1.965 mi. Sect. 2-M.F.T., 14 ft.; 5.61 mi. Sect. 3-M.F.T. 14 ft., both Carroll Co. G. H. Baker, engr. co. roads.

Ill., Watseka—Apr. 17, by Bd. Supervs. Iroquois Co., concrete surfacing 2.3201 mi. Sect. 54-M-F-T—1.178 mi. Sect. 83-M.F.T.—1.6024 mi. Sect. 84-M.F.T.

Ind., Anderson—Apr. 16, Auditor Madison Co., concrete surfacing 1.5 mi. Charles Smith Rd. in Alexandria, Monroe Twp., 18 ft. $26,000. P. Phipps, Anderson, engr.

Iowa—Apr. 14, by State Hy. Comn., Ames, grading, drainage structures, surfacing 0.137 mi. U. S. Rd. 32 east of Casey, F-145-C, Guthrie Co.—11.225 mi. Primary Rd. 59 from Rd. 9 to Minnesota State Line, F-190, Howard Co.—0.431 mi. U. S. Rd. 30 at Honey Creek, F-46, Pottawattamie Co.—22,550 bbl. cement in bulk f.o.b. Wellsburg—15,290 bbl. f.o.b. Grundy Center F-315—19,115 bbl. f.o.b. Grundy Center F-19, both Grundy Center Co.—6,695 bbl. f.o.b. Lovillia, P-294-B, Monroe Co., C. R. Jones, aud.

Ia., Des Moines—Apr. 15, at office Auditor Polk Co., gravel surfacing 31 mi. roads.

Ia., Lake Mills—Bids about Apr. 15, grading, curbing, concrete paving 25,000 sq.yd. W. E. Buell Co., 501 Insurance Exch. Bdlg., Sioux City, engrs.

Ia., Nevada—Apr. 15, at office Auditor Story Co., graveling trunk and local roads, incl. 77,000 cu.yd. gravel, 1 mi. haul, 800,000 units additional haul, 16,000 cu.yd. stripping. S. Steigerwalt, Nevada, co. engr.

Ia., Oskaloosa—Apr. 17, at office Auditor Mahaska Co., grading, incidental work 10 mi. roads.

Kansas—Apr. 15, by State Hy. Comn., Court House, Ellsworth, **(p. means Project and F.A.P. Federal Air Project)** grading, culverts, bridges 3.805 mi. P. 408-15B, F.A.P. 374-D Ellsworth Co.—light type surfacing 4 mi. P. 10-3, Kansas Project 1156—one 40 ft. and two 30 ft. deck girder spans, P. 13-6, F.A.P. 434-A, Morris Co. —oil and light type surfacing 6.904 mi. P. 18-11, F.A.P. 362-D—3 mi. P. 18-11, Kansas Project 1005, both Ottawa Co. W. V. Buck, Topeka, hy. engr.

Kansas—Apr. 17, by State Hy. Comn., Topeka **(P. means Project and F.A.P. Federal Aid Project)** grading, culverts 1.317 mi. P. 50-1, F.A.P. 422-A, incl. five 30 ft. deck girder spans, Hamilton Co.—oil and light type surfacing 8.637 mi. P. 45-3C, F.A.P. 423-C Stevens Co.—5.876 mi. P. 45-4, F.A.P. 423C, Haskell Co.—0.812 mi. P. 45-3D, F.A.P. 423B, Seward Co. W. V. Buck, Topeka, hy engr.

Kansas—Apr. 22, by State Hy. Comn., Court House, Mound City, grading, culverts, 7.412 mi. Project 7-13, F.A. 270-B, incl. four 30 ft. deck girder spans, and 5.935 mi. Project 7-14 F.A. 215-B, incl. six 30 ft. deck girder spans, both Linn Co. W. V. Buck, Topeka, hy. engr.

Kansas—Apr. 24, by State Hy. Comn., Court [illegible] Olathe, **(P. means Project and F.A.P. Federal Aid Project)** grading, culverts, bridges 7.526 mi. P. 50-44, F.A.P. 404-B—2.611 mi. P. 10-14, F.A.P. 315-D, incl. one 80 ft. steel truss and four 30 ft. deck girder spans—6.098 mi. P. 10-14, F.A.P. 315-G, all Johnson Co.—1.164 mi. P. 30-6, F.A.P. 307-C—7.406 mi. P. 30-7, F.A.P. 307-D—light type surfacing 5.411 mi. P. 92-2, F.A.P. 268-G—7.972 mi. P. 2, F.A.P. 268-F—1.067 mi. P. 92-2, F.A.P. 268-I, all Leavenworth Co. W. V. Buck, Topeka, hy. engr.

Kentucky—Apr. 29, by State Hy. Dpt., Frankfort, surfacing 10.8 mi. Wickliffe-Paducah Rd., Ballard Co.—0.6 mi. Greenup-Ashland Rd., Greenup Co.—grading, drainage structures, surfacing 1.1 mi. Princeton-Hopkinsville Rd., Caldwell Co.—grading, drainage structures 8.9 mi., Albany-Burkesville Rd. (re-opened), Clinton Co. —6.5 mi. Frankfort-Owenton Rd., Franklin Co. —12.4 mi. Eddyville-Fredonia Rd., Lyon and Caldwell Counties—16.9 mi. Cadiz-Tennessee State Line Rd., Trigg Co.—bridge at McCools Creek on Carrollton-Ghent Rd., and grading, drainage structures 0.6 mi. approaches to same, Carroll Co. B. Johnson, chn.

Maryland—Apr. 14, by State Roads Comn., Baltimore, concrete paving 1.94 mi. Contr. Wo-93-12, Worcester Co.—2.24 mi. Contr. H-111-44, Harford Co.—0.66 mi. Contr. D-68-17, Dorchester Co.—macadam resurfacing 1.96 mi. Contr. W-87-62, Washington Co.—gravel surfacing 1.23 mi. Contr. Ch-100-82, Charles Co. H. Williar, Jr., Federal Reserve Bldg., Baltimore, engr.; adv. E. N.-R. Apr. 9.

Md., Baltimore—Apr. 15, by Bd. Awards, concrete paving 15,750 sq.yd. road in vicinity of Prettyboy Dam, known as Armacost, Molesworth and Falls Rds., Contr. 595—20,000 sq.yd. footways listed in Footway Contr. 119—7,800 sq.yd. streets listed in Contr. 594. N. L. Smith, Municipal Bldg., hys. engr.

Mass., Boston—Apr. 13, by Dpt. P. Wks., sheet asphalt or bitulithic paving Lasell St., etc., Ward 20. $28,000. J. A. Rourke, comr.

Mass., Cambridge—Apr. 10, by W. R. McMenimen, supt. Streets, City Hall, repairing bituminous macadam pavements that are out of guarantee for fiscal year ending Dec. 31, 1931. $25,000 or more.

Mass., Wellesley—Apr. 10, by Town, bituminous macadam and asphalt resurfacing. $25,000 or more.

Mass., Westfield—Apr. 16, by Bd. P. Wks., O. E. Parks, supt., grading, concrete paving 8,500 cu.yd. Broad, Court and North Elm Sts.; adv. E. N.-R. Apr. 9.

Minnesota—Apr. 15, by C. M. Babcock, comr. hys., Duluth, crushed gravel surfacing 11.748 cu.yd. T.H.-1, Two Harbors to East Co. line—1,989 cu.yd. T.H.-1, Schroeder to West Co. line—7,934 cu.yd. T.H.-23, through Kanabac Co. 1,000 cu.yd. T.H.-5, Mora to South Co. line—crushed gravel surfacing 4,760 cu.yd. and pit run gravel surfacing 10,000 cu.yd. T.H.-23-Jct. T.H.-L to East Co. line. S. Shepard Court House, Duluth, co. engr.

Minn., Duluth—Apr. 12, by St. Louis Co., Court House **(C. means County)**, clearing 2 mi. S. Rd. 37, Project 4—2.75 mi. C. Rd. 322—4,508 ft. C. Rd. 625; 15,000 ft. C. Rd. 62—oiling 5 mi. C. Rd. 21—grading 0.25 mi. C. Rd. 21—1 mi. C. Rd. 112—15 stations on C. Rd. 404—1.6 mi. C. Rd. 442—0.75 mi. C. Rd. 636—1.75 mi. C. Rd. 647—0.25 mi. C. Rd 652—58 stations on C. Rd. 676—700 ft. on C. Rd. 101—0.25 mi. C. Rd. 597—1 mi. C. Rd. 98—surfacing 2 mi. C. Rd. 23—5 mi. C. Rd. 24—3.5 mi. C. Rd. 77—15 stations on C. Rd. 404, improving 3 mi. C. Rd. 114—graveling 1.5 mi. C. Rd. 48—0.5 mi. Town Rd. 806—2 mi. C. Rd. 371—1.275 ft. C. Rd. 610—2 mi. C. Rd. 114—2 mi. C. Rd. 488—C. Rd. 953—1,300 ft. C. Rd. 313—0.5 mi. C. Rd. 448—regrading, resurfacing 900 ft. C. Rd. 55—0.4 mi. C. Rd. 254—2 mi. C. Rd. 208—0.8 mi. C. Rd. 258—ditching on C. Rd. 16—C. Rd. 22—C. Rd. 25—C. Rd. 83—reconstructing bridges on C. Rd. 16, Projects 8 and 9—1 mi. C. Rd. 38—$59,474. S. B. Shepard, co. engr.

Neb., Omaha—Apr. 14, by City, curbing, paving 18,365 sq.yd. Ames Ave. H. Beal, city engr.

New Hampshire — Apr. 16, by State Hy. Dpt., Concord, 6 in. one course rein.-con. on 8 in. gravel base course paving 32,022 sq.yd. Mascoma Rd., Newport, 20 ft. $108,000.

N. J., Flemington — Apr. 16, by Bd. Freeholders Hunterdon Co., reconstructing Main and East Main Sts. W. E. Roberts, Flemington, co. engr.; adv. E. N.-R. Apr. 9.

N. J., Long Branch—Apr. 14, by Bd. City Comrs., City Hall, paving Morris and Chelsea Aves. O. R. Seaman, city engr.; adv. E. N.-R. Apr. 9.

New York—Apr. 14, by C. MacDonald, engr. Westchester Co. Court House, White Plains, grading, drainage, concrete curbing, sidewalks, rein.-con. paving 1.74 mi. Polly Park and Old White Plains Rds., in Port Chester, Rye and Harrison; adv. E. N.-R. Apr. 9.

New York—Apr. 28, by A. W. Brandt, comr. Hys., Albany, improving hys. in Columbia, Essex, Herkimer, Lewis, Oneida, Seneca and Tioga and Broome Counties; reconstructing hys. in Clinton, Delaware, Jefferson, Monroe and Orange Counties; adv. E. N.-R. Apr. 9.

N. Y., Brooklyn—See "Airports."

N. Y., Greenburgh—Apr. 20, by Westchester Co. Park Comn., 72 West Pondfield Rd., Bronxville, grading, paving 0.46 mi. Central Westchester Parkway, through the former McLean Estate. Contr. 352. J. Downer, Bronxville, ch. engr.; adv. E. N.-R. Apr. 9.

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Streets and Roads (Continued)

N. Y., New York—Apr. 16, by H. Bruckner, pres. Bronx Boro, Crotona Park, 3rd and Tremont Aves., asphalt block on concrete repaving East 182nd St. and University Ave.—sheet asphalt on concrete paving West 172nd St., Lurting and Olinville Aves.—granite block on concrete repaving Courtlandt and Morris Aves.—sewer in Harper Ave.

N. Y., St. George—Apr. 15, by J. A. Lynch, pres. Richmond Boro, Boro Hall, bituminous concrete repaving Cary Ave. from Bway. to Clove Rd.

N. Y., Syracuse—Apr. 13, by Bd. Contr. & Supply, resurfacing Summit Ave., South Clinton, Elliott, Putnam, Kirkpatrick, Shonnard, Danford, South State Sts. $227,280. W. W. Cronin, State Tower Bldg., engr.

O., Parma (br. Cleveland)—Taking bids concrete, sheet asphalt or asphaltic concrete paving 7,500 sq.yd. Keystone Rd. and Oxford Blvd. $35,000. V. Clark, City Hall, engr.

O., Cincinnati—Apr. 10, by Comrs. Hamilton Co., surface treating 157 mi. roads, 18 ft. incl. 370,000 gals. tar, 11,100 cu.yd. sand, 1,480,000 sq.yd. cleaning. $81,400. E. A. Gast, Court House, engr.

Okla., Nichols Hills (Oklahoma City, P. O.)—Apr. 13, by T. A. Montague, city clk., grading, paving 20 blocks Avondale Dr., Trenton and Grand Blvd., 26 ft. $62,880; 6 blocks Strand Ave., 60 ft., $41,375. Benham Eng. Co., Perrine Bldg., Oklahoma City, engrs.

Pennsylvania—Apr. 17, by State Hy. Dpt., Harrisburg, **(R. means Route)** grading, drainage structures, bituminous surface treated macadam surfacing 17,002 ft. also grading 155 ft. approaches to 2 bridges, R-704, Hovey, Allegheny and Scrubgrass Twps., Armstrong, Butler and Venango Counties—12.078 ft. R-310, Tulpehocken and Bethel Twps., Berks Co.—44,657 ft. R-656, Sect. 1, incl. 38 ft. rein.-con. bridge, Bedminster, Plumstead and Buckingham Twps., Bucks Co.—35,654 ft. R-237, Redbank Twp., Hawthorne Boro, incl. 46 ft. rein.-con. bridge—9,085 ft. R-380, Farmington Twp., both Clarion Co.—29,877 ft. R-669, Sect. 1, Gulich and Woodward Twps., Clearfield Co., incl. 33 ft. rein.-con. bridge—1,548 ft. R-556, Sect. 1, Bensinger Twp., St. Marys Boro, Elk Twp.—rein.-con. paving 1,548 mi. same road, incl. rein.-con. arch bridge—22,291 ft. R-556, Sect. 2, Benzinger and Ridgway Twps., Johnsonburg Boro, incl. 41 ft. rein.-con. bridge, all foregoing in Elk Co.—25,598 ft. R-261, Sect. 4, Oneida and Miller Twps., also grading, drainage structures 425 ft. same road, incl. 9 ft. rein.-con. bridge, Huntington Co.—28,242 ft. R-316, Sect. 3, Auburn and Rush Twps., Susquehanna Co., also grading 173 ft. bridge approaches—6,706 ft. R-27, Limestone Twp., Union Co.—30,608 ft. R-53 and 276, Sects. 4 and 11, Gallitzin Twp., Ashville Boro, Cambria Co. S. S. Lewis, secy.

Pennsylvania—Apr. 23 and 24, by State Hy. Dpt., Harrisburg, surfacing 100 mi. roads in Allegheny, Bedford, Fulton, Bucks, Chester, Columbia, Franklin, Perry, Greene, Jefferson, McKean, Pike, Monroe, Montour, Columbia, Montgomery, Somerset, Union, Warren, McKean, and Westmoreland Counties. S. S. Lewis, secy.; adv. E. N.-R. Apr. 9.

Pa., Phila.—Apr. 21, by Bureau Hys., Dpt. P. Wks., City Hall Annex, A. Murdock, dir., schedule A, asphalt paving (assessment work) Crittenden St. from Roumfort to Cresheim Sts., F St. from Atlantic to Venango Sts., Mansfield St., from Washington Lane to Upsal St. and Thomas St., from Pickwick to Castor Sts.—Schedule B, curbing and footway work, 3rd Hy. Dist. (cost to be paid by city)—Schedule C, furnishing, delivering 565 pieces various sizes terra cotta pipe—Schedule D, demolition and removal of building at line of Passyunk Ave.

R. I., East Providence (br. Providence)—Apr. 15, by Bd. Contr. & Purchase, 235 cu.yd. rock and 800 cu.yd. earth excav., and 250 cu.yd. gravel on Bond Rd.—1,500 cu.yd. earth excav., 250 cu.yd. gravel, Burke St.—1,200 cu.yd. earth excav.; 350 cu.yd. gravel, Rogers Ave.

Tex., Brownsville—Cameron Co., c/o J. F. Baughn and J. F. Logan,. comrs., Harlingen, taking bids and open same about Apr. 15, hard paving in Precinct 4. $350,000. W. O. Washington, Brownsville, co. engr.

Tex., Memphis—Apr. 25, by Comrs. Court, Hall Co., c/o A. C. Hoffman, judge, concrete paving on 11.17 mi. finished graded road, 18 ft., incl. 278,635 lb. reinforcing steel for pavement, 5,580 lin.ft. wire mesh guard fence, 5,580 lin.ft. timber guard fence. Hasie Eng. Co., Inc., Memphis, engrs. Noted Apr. 2 under "Bids Asked."

Utah—Apr. 13, by State Rd. Comn., Salt Lake City, concrete paving 4 mi. Hy. between Mills Junction and Tooele, Tooele Co. H. S. Kerr, state road, engr.

Virginia—Apr. 14, by State Hy. Comn., Richmond, **(R. means Route and P. Project)** clearing, grubbing, grading, drainage structures, concrete surfacing 2.3 mi. Ashland Rd., R. 31, P. F-260-BW, Hanover Co.—clearing, grubbing, grading, drainage structures, macadam surface treating 3.6 mi. Lucketts-Limestone Rd., R. 32, P. F-399-AB1, Loudon Co.—0.6 mi. Narrows Rd., R. 23, P. F-435-A2, Giles Co.—1.8 mi. Bristol Rd., R. 10, P. F-499-D, Washington Co.—grading, drainage structures, clearing, grubbing, soil surface treating 7.3 mi. Westland-Whitestone Rd., R. 37, P. F-712-A, Lancaster Co.—22½ ft. arch bridge 10 mi. from Gladstone, R. 13, P. F-658-B, Buckingham Co.—130 ft. steel, concrete bridge near Palmyra, R. 32, P. F-493-B Fluvanna Co. H. G. Shirley, hy. engr.

Wash., Seattle—Bd. P. Wks., bids about June 1, grading, sidewalks, sewers, watermains, widening, new lighting system, repaving Bway. Ave. N. $90,000. R. H. Thomson, city engr.

West Virginia—Apr. 21, by State Hy. Comn., Charleston, **(P. means Project)**, concrete surfacing 2.55 mi. Glen Jean-Mount Hope Rd., P.173-F Fayette Co.—2.37 mi. Gormania-Bayard Rd., P-3469 Grant Co.—0.32 mi. Kearneysville Underpass, P-3217-B Jefferson Co.—grading, retread on stone surfacing 4.7 mi. Lewisburg-Maxwelton Rd., P.2024 and 54 Greenbrier Co.—grading, drainage structures, shale surfacing 11 mi. Lost City Rd., P.3471-B—3.8 mi. Wardensville-Hampshire Co. Line Rd., P.3490, both Hardy Co.—cold tar surface treating 8.8 mi. Point Pleasant-Clifton Rd., P.3057 Mason Co.—12.9 mi. Roderfield-Wyoming Co. Line Rd., Projects 3129, 3385 and 3386 McDowell Co.—traffic bound stone top surfacing 5.96 mi. Horsepen-Justice Rd., Projects 3345 and 3347 Mingo Co.—gravel surfacing 5.58 McLean Turnpike, P.3429-A and B Putnam Co.—grading, concrete surfacing 0.88 mi. Point Pleasant-Henderson Rd., P.3472 Mason Co.—100,000 lin.ft. wire rope guard rail on Northwestern Turnpike, U. S. Route 50, Grant, Hampshire and Mineral Counties—175,000 lin.ft. wire rope guard rail State Route 24, Preston, Tucker and Randolph Counties—Ellamore Bridge 1249, 190 ft. steel through pass superstructure on concrete substructure, Projects 3212-B and 3448, Ellamore Co.—680 ft. new floor system Fudges Creek Bridge 822, P. 174-B Cabell Co. G. W. White, secy.

Wisconsin—Apr. 14, by State Hy. Comn. and Committees Chippewa, Dunn and Taylor Counties, Madison, grading, concrete surfacing 12.99 mi. Medford-Prentice Rd., S.T.H. 13, F.A.P. 31, 331, and 332-A, Taylor Co.—constructing Vojrt Bridge, S.T.H. 26, S.A.P. 6133, Chippewa Co.—Johnson Bridge on S.T.H. 29, S.A.P. 6101, Dunn Co.

Wisconsin—Apr. 15, by State Hy. Comn. and Committees Brown, Calumet, Outagamie, Shawano and Kewaunee Counties, Div. Office 3, Nicolet Bldg., Green Bay, grading, concrete paving 2.881 mi. Dykesville-North County Line Rd., S.T.H. 57, F.A.P. 163, Kewaunee Co.—2.133 mi. South County Line—Askeaton Rd., S.T.H. 57, F.A.P. 465-A, Brown Co.—6.42 mi. Hilbbert—North County Line Rd., Calumet Co.—grading, culverts, bridges, concrete surfacing 3.757 mi. Sherwood-North County Rd., S.T.H. 55, S.A.P. 3376, Calumet Co.—1.524 mi. South County Line-Kaukauna Rd., S.T.H. 55, S.A.P. 3378, Outagamie Co.—9.09 mi. Chawano-Tilleda Rd., S.T.H. 29, F.A.P. 57 and 247, Shawano Co.

Wisconsin—Apr. 17, by State Hy. Comn. and Committees Lincoln and Price Counties, Court House, Rhinelander, concrete surfacing 10.98 mi Marshfield—Prentice Rd., S.T.H. 13, F.A.P. 332-C, Price Co.—10.3 mi. Merrill-Tomahawk Rd., Sect. L, U. S. Ry. 51, F.A.P. 167 and 223, Lincoln Co.—7.15 mi. Merrill-Tomahawk Rd., Sect. 2, U. S. Hy. 51, F.A.P. 223 and 431-A, Lincoln Co.

Ont., Belleville—See "Contracts Awarded."

Ont., Chatham—See "Contracts Awarded."

Ont., Hamilton—See "Contracts Awarded."

Ont., London—See "Contracts Awarded."

CONTRACTS AWARDED

Alabama—State Hy. Dpt., Montgomery, concrete paving 15.719 mi. Robertsdale-Perdido River, 18 ft., Baldwin Co., to Van Gordon Constr. Co., Montgomery, $217,002. State furnishing cement. Noted Feb. 5.

Arizona—State Hy. Comn., Phoenix, grading, draining, sub-grade stabilizer on Tempe Bridge approaches, Phoenix-Tempe Hy., F.A.P. 2-B, Maricopa Co., to R. H. Martin, 311 North 3rd Ave., Tucson, $25,489. Rejected bids Mar. 23. oiling 17.8 mi. Coconino-Yavapai Co. line W. Ash Fork-Kingman Hy., et al, Coconino Co., will readvertise. Noted Mar. 19.

Arkansas—State Hy. Comn., Little Rock, concrete surfacing 4 mi. Caddo River-DeRoche Creek Rd., Clark Co., and grading, concrete surfacing 9.5 mi. Pulaski-Lonoke County Line Rd., Lonoke Co., to J. P. McNulty, Pine Bluff, $56,509 and $155,390 respectively ests. $70,000 and $160,000 respectively—concrete surfacing 5 mi. Ozark-Altos Rd., Franklin Co., to Garrett Constr. Co., Springfield, Mo., $93,544 est., $110,000—4.5 mi. Little Rock Rd., Pulaski Co., to E. W. Barker & Co., Perrine Bldg., Oklahoma City, Okla., $82,757 est. $110,000. Grand total $388,200.

California — State Hy. Comn., Sacramento, improving road between Pepperwood School and and Little Dann Creek, incl. grading 5.5 mi. 24 ft. wide, butuminous treated gravel surfacing 13.5 mi. 20 ft. wide, Mendocino Co. to E. C. Coats, 1801 P. St., Sacramento, $439,471. Noted Mar. 5.

Calif., San Gabriel—I. H. Stouffer, city clk., grading, curbing, 4 in. warrenite paving 100,250 sq.ft. Hermosa Dr., to Hall-Johnson Co., 905 Westminister St., Alhambra, $16,054. Noted Mar. 19

Conn., West Hartford (br. Hartford)—Penetration macadam paving 8,400 lin.ft. streets, to Lane Constr. Co., 35 Colony St., Meriden, $31,707. Est. $40,000. Noted Mar. 20 Daily.

Idaho—A. Harbour, comr. P. Wks., Boise, grading, graveling 7,964 mi. Blaine Co., to Eckert & Stokes, Glenns Ferry, $40,765—6.01 mi. Canyon Co., to Quinn-Robbins Co., Boise, $57,753—5.001 mi. Fremont Co., to Western Constr. Co., Pocatello, $42,990—12.266 mi. Nez Perce and Clearwater Counties, to Idaho Contr. Co., Boise, $31,685—grading, draining, crushed rock surfacing 9.671 mi. Nez Perce Co., to General Constr. Co., Colman Bldg., Seattle, Wash., $219,220. Grand total $392,413. Noted Mar. 18 Daily.

Ill., Chicago—Bd. Comrs. Cook Co., County Bldg., to Pronger Bros., Blue Island, paving Sect. 051-1214-15D Crawford Ave., $41,944—to Municipal Paving Co., Oak Park, Sect. 039-2424-15D Harlem Ave. $19,246—to Standard Paving Co., 344 North Parkside Ave. Sect. 145-1212-15D Fullerton Ave. $24,081—to Universal Paving Co., Oak Park, Sect. 136-1011-15D Foster Ave. $19,587—to Acme Eng. Co., 20 North Wacker Dr., Sect. 030-0101-15D River Road Cut-off, $40,795—to Broadway Constr. Co., 205 West Wacker Dr., Sect. 136-0101-15D Montrose Ave. $11,432—to L. D. Lain, Park Ridge, Sect. 126-3326-15D Touhy Ave. $88,765—to Chicago Heights Coal Co., Chicago Heights, Sect. 154-0203-15D Western Ave. $11,060—to Arcole Constr. Co., Evanston, Sect. 065-1820-15D South Chicago Ave., $48,356. Sect. 031-2222-15D Pfingsten Ave. $18,807. Sect. 042-1013-15D Sherman Ave. $64,166. Sect. 031-1821-15D Pfingsten Ave. $58,255. Grand total $426,494

Ill., Wilmette—Bd. Local Imprvts., E. E. Otner, pres., grading, curbing, sidewalks, concrete paving 90,600 sq.yd. Elmwood Ave., other streets, to Arcole Constr. Co., Niles Center, $210,553. Est. $353,000.

Indiana—State Hy. Comn., Indianapolis, grading, drainage structures, concrete surfacing 4.746 mi. Rd. 20, Gary-Michigan City Rd., 19 ft. to Barnes Bros. & Co., Inc., Gary, $263,670. Est. $263,698.

Indiana—State Hy. Comn., Indianapolis, grading, drainage structures, concrete surfacing 5.843 mi. road in Knox and Daviess Counties, to Premier Constr. Co., Lemcke Bldg., Indianapolis, $95,601 est. $122,997—15.25 mi. White-Co., to Cunningham Constr. Co., 301 West Washington St., Indianapolis, $249,391 est. $322,922—14.445 mi. Bartholomew and Jennings Counties, to T. R. Price & Co., Bloomington, $278,706 est. $339,879—24.729 mi. Hamilton, Boone and Clinton Counties, to W. H. Vogel, 506 Inland Bank Bldg., Indianapolis, $416,272 est. $515,931. Grand total $1,039,970. Noted Feb. 12.

Iowa—State Hy. Comn., Ames, grading, drainage structures, surfacing 14.486 mi. roads in Clay Co., to Henkel Constr. Co., Mason City, $271,221—1.472 mi. Fayette Co. and 18.131 mi. Winnebago Co., to J. P. Abramson, Des Moines, $36,578 and $350,785 respectively—gravel surfacing 0.648 mi. Fayette Co., to A. R. Hewitt, Westgate, $1,319. Grand total $659,903. Noted Mar. 26.

Kan., Kansas City—City Council, Warrenite bitulithic paving 18th St., to Granite Bituminous Paving Co., Railway Exch. Bldg., St. Louis, Mo., $96,749.

Kan., Kansas City—Wyandotte Co., concrete paving 5 mi. Edwardsville-Maywood Rd., 18 ft. and 6 ft. earth shoulders, to H. C. Botsford, 650 West 69th St. Terrace, Kansas City, $118,375.

Kentucky—State Hy. Dpt., Frankfort, grading, drainage structures, using first class pipe, 2.671 mi. Tip Top-Grahampton Rd., Meade Co., to Myers Bros., Campbellsburg, $25,900; 3.334 mi. Tompkinsville-Meshack-Burkesville Rd., Monroe Co., to Lewis-McComas & Co., Burkesville, $29,496. Noted Mar. 13, 1930.

Md., Baltimore—Bd. Awards, sheet asphalt paving 8,100 sq.yd. streets listed in Contr. 591, to Amer. Paving Co., Montebello Ave., $23,602; concrete paving 10,950 sq.yd. streets listed in Contr. 590, to D. Marine, 2 East Lexington St., $19,656. Noted Mar. 19.

Mass., Boston—Dpt. P. Wks., J. A. Rourke, comr., bituminous paving as specified, streets in Sect. 1, to Central Constr. Co., 228 Southampton St., $118,705; streets as specified in Sect. 2, to M. F. Gaddis, 6 Beacon St., $118,845. Noted Mar. 18, Daily.

Montana—State Hy. Comn., Helena, to Nolan Bros., 18 North 2nd St., Minneapolis, Minn., graveling, oil treating 42.228 mi. Rosebud and Custer Counties, $75,895 est. $62,415—to Syster & Rathbun, Shelby, grading, crushed gravel surfacing 7.606 mi. Hill Co., $31,723 est. $42,804—to Winston Bros. Co., 1464 Northwest Bank Bldg., Minneapolis, Minn., 17.153 mi. Phillips Co., $147,641 est. $170,453; 20.253 mi. Valley Co., $129,771 est. $153,448; 31.831 mi. Park and Sweet Grass Counties, $284,230 est. $341,484; 29.496 mi. Sanders Co. $147,888 est. $180,203; bridges in Valley Co. $25,510 est. $34,777; Sanders Co. $10,452 est. $12,252—to L. T. Lawler, Butte, graveling 26.14 mi. Granite Co., $205,866 est. $188,577—to F. R. Hewith, Spokane, Wash., 24.42 mi. Missoula and Ravalli Counties, $60,707 est. $60,707—to J. M. Carter, Billings, 24.011 mi. Yellowstone and Musselshell Counties, $86,645 est. $131,424—to E. Stamsis, Butte, bridge in Granite Co. $17,356 est. $19,390—to B. M. Crenshaw, Livingston bridge in Park and Sweet Grass Counties, $7,396 est. $9,022—to Mackin & Berg, Brockway, bridges in Phillips Co., $35,285 est. $45,772. Grand total $1,270,363. Noted Mar. 20.

Nebraska—Dpt. P. Wks., Lincoln, to Western Bridge & Constr. Co., 3867 Leavenworth St., Omaha, grading protection work 3.9 mi. Maxwell-Fort McPherson Rd., Project 318, $40,787; sand gravel surfacing same road, $2,444; culverts $679—to General Constr. Co., 532 Peters Trust Bldg., Omaha, bridges on same road $78,586—to Beatrice Steel Tank Mfg. Co., Beatrice, driveway culverts $54. Grand total, $122,550. Noted Mar. 12. Daily.

Nevada—Directors Dpt. Hys., Carson City, grading, gravel surfacing 19.06 mi. hy. between point 5 mi. East Holbrook point 2 mi. north Carters and point 4 mi. south to Gardnerville, Route 3, Sects. A2, B1 and B2, Douglas Co., 23.21 mi. Dutch Creek to Schurz, Route 3 and 1-A, Sects. E, F and B, Mineral Co. to Isbell Constr. Co., Carson City, $74,841 and $208,770 respectively. Noted Mar. 19.

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Streets and Roads (Continued)

New Jersey—State Hy. Comn., Trenton, paving 1.1 mi. Bergen Co., to R. J. Fox, Grantwood, $139,772. Noted Mar. 19.

New York—A. W. Murray, town supt. hys., Huntington Twp., Patchogue, curbing, guttering, rein.-con. paving, roads in Stony Brook, East Setauket, Port Jefferson, to R. W. S. Constr. Co., Huntington, $37,275.

N. Y., Long Island City—G. U. Harvey, pres. Queens Boro, Queens Subway Bldg., grading Interboro Parkway, to Welsh Bros. Contg. Co., 35 Purvis St., $412,427. Noted Mar. 5.

N. Y., New York—W. J. Flynn, acting pres. Bronx Boro, Boro Hall, Crotona Park, 3rd and Tremont Aves., asphalt paving West 233rd St. and East 211th St., to C. D. Beckwith, Inc., Seneca Ave. and Edgewater Rd., $7,450 and $8,133 respectively—East 173rd St., to Venetian Contg. Co., 2 Lafayette St., $8,896—grading Pelham Parkway, to Gallow Kearns Constr. Co., 941 Longfellow Ave., $24,917—Harper Ave., to P. Mascali, 454 Tremont Ave., $7,816—sewers in Ely and Kingsland Aves., to A. Spadaro, 724 East 225th St., $3,355 and $3,130 respectively. Grand total, $63,697. Noted Mar. 19.

N. Y., New York—S. Levy, pres. Manhattan Boro, Municipal Bldg., to C. D. Beckwith, Inc., Seneca Ave. and Edgewater Rd., asphalt paving Pine, St., $6,448—to Meehan Paving Co., 90 West St., Lexington Ave. $59,814; granite block on concrete paving 9th Ave., $153,536; Franklin St., $24,266; Manhattan Bridge Plaza, $5,500—to Regan Towers Co., 214 West 121st St., Jacob St., $8,043—to St. George Paving Co., 415 Lexington Ave. Gold St., $28,113. Grand total, $285,720. Noted Mar. 12.

N. Y., St. George—J. A. Lynch, pres. Richmond Boro, Boro Hall, macadam paving St. Joseph's and Morrison Aves., to Vanbro Constr. Co., 24 Elizabeth St., West New Brighton, $3,194 and $1,556 respectively—grading Maple Parkway, to J. E. Donovan, 2205 Richmond Terrace, Port Richmond, $1,128. Grand total $5,878. Noted Mar. 12.

North Carolina—State Hy. Comn., Raleigh (**P. means Project**), to Murray Constr. Co., Greensboro, grading, drainage structures, concrete paving 3.31 mi. P. 5070, Alamance Co., $76,449; 7.94 mi. P. 8451, McDowell Co., $156,973; 3.95 mi. P. 9081, Buncombe Co., $116,016—to Jamison Bros., Inc., Cotton Sales Bldg., Nashville, Tenn., clearing, grading, drainage structures, topsoiling 8.79 mi. P. 6693, Rowan Co., $27,018; 15.6 mi. P. 7961 Yadkin Co., $122,106 — to Guilford Constr. Co., Greensboro, clearing, grading, drainage structures, concrete paving 6.07 mi. P. 4460, Lee Co., $126,623—to Cornell-Young Co., Macon, Ga., grading, drainage structures, concrete paving 9.66 mi. P. 4364, Harnett Co., $189,450; 7.65 mi. P. 5551, Randolph Co., $131,347. Grand total $945,982. Noted Mar. 5.

North Dakota—State Hy. Dpt., Bismarck, to W. Coman, Goodrich, graveling 6.308 mi. Divide Co. $14,881; 9.248 mi. Oliver Co. $13,127—to S. F. Lambert, Bismarck, 17.592 mi. Hettinger Co. $21,867—to Butler Constr. Co., Grand Forks, 15.991 mi. Mountrail Co. $19,268—to Hector Constr. Co., Hector, Minn., 14.215 mi. McLean and Burleigh-McLean Counties $19,066; 18.241 Emmons Co. $23,886; 11.924 mi. Barnes Co. $27,155—to Megarry Bros., Rain, Minn., 13.631 mi. Dickey Co. $15,168; 21.049 mi. Benson Co. $18,702—to C. Byers, Hampton, Ia., 6.409 mi. Mercer Co. $5,900—to W. Fahey, Lakota, grading 10.187 mi. Ramsey Co. $26,951—to F. O. Smith, Steele, 14.396 mi. McKenzie Co. $46,435—to Schultz Bros., Bowbells, 5.98 mi. Stutsman Co. $15,714; structural steel McKenzie Co. $3,492—to S. H. LeRew, Jamestown, structural steel in Stutsman Co. $2,620—to Northwestern Sheet & Iron Wks., Wahpeton, corrugated metal pipe culverts, Ramsey Co. $858; Stutsman Co. $124—to North Dakota Metal Culvert Co., Mandan, McKenzie Co., $1,120—to North Dakota Concrete Products Co., Mandan, concrete pipe culverts, Ramsey Co. $2,728; McKenzie Co. $4,789—to Concrete Sectional Culvert Co., Fargo, Stutsman Co. $1,423. Grand total $285,274. Noted Mar. 18 Daily.

O., Akron—See "Airports."

O., Cleveland—Stone curbing, grading, vitr. brick paving 8,960 sq.yd. East 79th St., to Highway Constr. Co., Builders Exch. Bldg., $71,488—stone curbing, grading, sheet asphalt paving 15,860 sq.yd. Central Ave., from Ontario to East 14th Sts., to Cleveland Trinidad Paving Co., Western Reserve Bldg., $74,571—grading, brick paving 5,460 sq.yd. Buechner Ave. and grading, stone curbing, sheet asphalt lake oil surfacing 810 sq.yd. West 45th St., to Baldwin Bros., Union Trust Bldg., $21,841 and $3,120 respectively—grading, stone curbing, bitulithic concrete lake oil surfacing 1,130 sq.yd. Lytton Ave., to Gould Constr. Co., 16113 Saranac Rd., $4,926—grading, stone curbing, sheet asphalt lake oil surfacing 2,950 sq.yd. Pallister Dr., to Enterprise Paving & Constr. Co., 8444 Broadway, $12,292—grading, stone curbing, brick paving 380 sq.yd. Rodman Court, to H. G. Herring, Wayside Rd., $2,203. Grand total, $190,441.

Pennsylvania — State Hy. Dpt., Harrisburg, grading, rein.-con. surfacing 30,350 sq.yd. Route 373, Cheltenham Twp., Montgomery Co., to Union Paving Co., Broad and Stiles Sts., Phila., $122,361. Noted Dec. 4.

South Dakota—State Hy. Comn., Pierre, concrete paving 17.54 mi. Minnehaha Co., to C. A. Wagner Constr. Co., Sioux Falls, $398,399—graveling 7.56 mi. Dewey Co., to Summit Constr.

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Co., Summit, $10,565—19.503 mi. Gregory Co., to W. E. Bartholow & Sons Constr. Co., Spencer, $49,042—19.388 mi. Brule and Charles Mix Counties, to Thiesen Bros., Osmond, Neb., $20,526—grading 14.631 mi. Hamlin Co., to A. F. Jarvis, Sioux Falls, $45,450—0.424 mi. Beadle Co. and 1.001 mi. Hand Co., to Hoskins Brso., Huron, $6,011 and $9,375 respectively—10.087 mi. Haakon Co., to Jahnig & Davis, Britton, $56,764—3.875 mi. Pennington Co., to Chaulk & Birdsall, Leade, $108,209—12.899 mi. Lyman Co., to E. Gustafson, Salem, $38,746—3,800 ft. Lyman Co. to E. J. Maloney, Madison, $2,074. Grand total $745,161. Noted Mar. 19.

Texas—G. Gilchrist, state hy. engr., Austin, (**F.A.P. means Federal Aid Project and S.A.P. State Aid Project**), to D. H. Purvis & Sons, Box 706, Fort Worth, grading drainage structures 15.395 mi. Hy. 51, State Project 959-C, Haskell Co., $26,637 est. $44,000; 11.304 mi. Hy. 5, F.A.P. 549-D, Cooke Co., $49,347 est. $70,000; 7.533 mi. Hy. 21, F.A.P. 620-A, Unit 1, Brazos Co., $69,566 est. $92,000—to E. T. Prater, Memphis, 14.653 mi. Hy. 18, F.A.P. 602-A, Hall Co., $30,534 est. $46,000—to C. E. Deal, Waller, 7.182 mi. Hy. 40, F.A.P. 566-B and State Project 961-B, Cherokee Co., $56,401, est. $70,000—to Huddleston Constr. Co., Crosbyton, 12.785 mi. Hy. 18, State Project 585-B and F.A.P. 446-B, Motley Co., $52,040 est. $72,000, all foregoing 26 ft. wide—to Lone Star Constr. Co., 804 Milam Bldg., San Antonio, triple asphalt on gravel surface treating 8.262 mi. Hy. 40, S.A.P. 802, Unit 2 and F.A.P. 117 reopened, Sect. B, Denton Co., $67,006 est. $100,000—to Central Bitulithic Co., 1015 Praetorian Bldg., Dallas, rein.-con. paving 6.484 mi. Hy. 114, State Project 839 G and H, Unit 2, Dallas Co., $175,337 est. $220,000—to Dexter Constr. Co., Hangar No. 10, Love Field, Dallas, 10.606 mi. Hy. 15, F.A.P. 526 A, B, and C, Unit 2, Kaufman and Dallas Counties, $196,140 est. $260,000—to Lacy Paving Co., 202 Burt Bldg., Dallas, concrete paving 9.88 mi. Hy. 6, F.A.P. 535-C and D, S.A.P. 778-C, Waller Co., $187,407 est. $240,000—to L. E. Whitham & Co., 804 East 4th St., Austin, 14.366 mi. Hy. 30, F.A.P. 603-A, Unit 2, Haskell Co., $232,924 est. $300,000—to Russ Mitchell, Inc., 710 Petroleum Bldg., Houston, 14.6 mi. Hy. 29, F.A.P. 508-A, Unit 2, Victoria Co., $253,947 est. $320,000—to Brown & Root, Inc., Norwood Bldg., Austin, limestone rock asphalt on concrete base course surfacing 7.306 mi. Hy. 3-A, F.A.P. 521-B, Unit 2, Guadalupe Co., $139,964 est. $160,000—to E. R. Leach, Dallas, triple asphalt on caliche base and surface course paving 9.375 mi. Hy. 137, State Project 936-B, Unit 2, Ector Co., $72,369 est. $110,000, all foregoing 18 ft. wide. Grand total $1,609,619. Noted Mar. 26.

Utah—State Hy. Comn., Salt Lake City, grading, graveling 12.8 mi. Lincoln Hy., Tooele Co., to Dodge Bros., Fallon, Nev., $13,805, est. $23,350, grading, draining, bridging, surfacing 2.1 mi. Midland Trail, Carbon Co., to Utah Constr. Co., Ogden, $180,343. Noted Mar. 20 and 23 Daily.

Utah—State Rd. Comn., Salt Lake City, grading, surfacing 7.524 mi. Grand Canyon Hy., Kane Co., to W. W. Clyde & J. W. Whiting, Springville, $72,919 est. $88,775; steel bridge on concrete piers, Grand Canyon Hy., Kane Co., to Strong & Grant, Springville, $33,287 est. $41,868.

Utah—State Rd. Comn., Salt Lake City, grading, draining, surfacing 4.804 mi. Moab Monticello Rd., San Juan Co., to Reynolds Ely Constr. Co., Springville, $109,160. Est. $115,663. Noted Mar. 12.

Virginia—State Hy. Dpt., Richmond, clearing, grubbing, grading, drainage structures, one course macadam surface treating 2.487 mi. road in Campbell Co., to N. L. Teer, Durham, N. C., $81,012—3.2 mi. Campbell Co., to S. E. Finley, Bedford, $83,009—grading, drainage structures, 1½ in. westphalt surfacing 1.427 mi. Henrico Co., to G. P. Clay, Richmond, $40,026—clearing, grubbing, grading, drainage structures 2.8 mi. Wise Co., to Sutherland Bros., Clintwood, $34,720—seven 30 ft. concrete beam span and 150 ft. steel truss span bridge over Rivianna River, Fluvanna Co., to Alley Constr. Co., Bristol, $29,089. Grand total $267,855. Grading, drainage structures, one course macadam surfacing 2.6 mi. Halls Hills-Fall Church Rd., Route 21, Project F-314-W, Arlington and Fairfax Counties from Spotsylvania Constr. Co., Inc., Highland Springs, $66,303. Noted Mar. 12.

Virginia—State Hy. Dpt., Richmond, applying 3,187,500 gal. surface treatment material in Bristol, Richmond and Salem Dists., to Sam E. Finley Co., 292 North Avenue N.W., Atlanta, Ga., $23,161—1,446,000 gal. in Lynchburg and Suffolk Dists., to Lansdell Co., Phila., Pa., $15,394—furnishing 6,955,000 gal. bituminous surface treatment and patching material for Bristol, Salem, Fredericksburg, Lynchburg and Richmond Dists., to Texas Co., 1000 Alma St., Dallas, Tex., $370,612—1,974,000 gal. for Staunton and Culpepper Dists., to Atlantic Refining Co., 260 South Broad St., Phila., Pa., $109,152—1,260,000 gal. for Suffolk Dist., to Mexican Petroleum Corp., 122 East 42nd St., New York, $64,165. Grand total $582,484. Noted Mar. 12, under "Materials."

Washington—S. J. Humes, dir. Hys., Olympia, grading new road on Olympia, to Kesterson, Fisher & House, Seattle, $147,852; paving 5.4 mi. Sunset Hy., King Co., to Fiorito Bros., 3950 6th St. N.E., Seattle, $118,157. Noted Mar. 5.

Wash., South Bend—Comrs. Pacific Co., gravel surfacing 1.8 mi. State Rd. 5, 22 ft., to Twin Harbor Dredging Co., Hoquiam, $37,735.

Wash., Walla Walla—Walla Walla Co., surfacing 5,000 sq.yd. Lateral Hy. 2, Touchet River Rd., to C. B. Quinten, Clarkston, $37,510. Est. $40,000.

Wash., Tacoma—Paving, mains in Sheridan Ave., to Paine Galluci, Inc., 1521 Grand St., $33,263.

Wisconsin — State Hy. Comn., Milwaukee, grading 4.98 mi. Warren-Gratiot Rd., Grant Co., to F. Kutzke, Brooklyn, $25,339—5.93 mi. Dubuque-Platteville Rd., and 5.045 mi. Dodgeville-Prairie du Chein Rd., to S. J. Groves, 529 South 7th St., Minneapolis, Minn., $59,300 and $48,072 respectively — 13.82 mi. Mount Ida-Bridgeport Rd., and 10.9 mi. Mount Ida Fennimore Rd., to G. Needham, Fennimore, $17,955 and $19,020 respectively, all foregoing Grant Co.—3.823 mi. Trempealeau Co. to Williams & Williams, Strum, $41,382—6.899 mi. Jackson and Monroe Counties, to Nelson, Mullen & Nelson, 355 Gateway Bldg., Minneapolis, Minn., $78,573—10.586 mi. Middle Ridge-La Crosse Rd., to A. C. Dixon, 325 Gilfillian Bldg., St. Paul Minn., $44,396—concrete paving 7.891 mi. Eau Claire Co., to P. C. Kroeck, 1390 Lake Dr., Milwaukee, $178,606—10.253 mi. Osseo-Eau Claire Rd. and 3.607 mi. Ellsworth-Plum City Rd., to Lex Constr. Co., 82nd and Slinger Aves., West Allis, $210,809 and $127,262 respectively—stone paving 3.53 mi. Plum City-Durand Rd., to Barnard-Curtiss Co., 504 Globe Bldg., Minneapolis, Minn., $50,112—shale surfacing 2.99 mi. Dunn Co., to L. A. Bumgardner & Co., 916 New York Bldg., St. Paul, Minn., $38,357—Apple River Bridge, St. Croix Co., to J. R. McLean, Superior, $9,841. Grand total $949,024. Rejected bids Mar. 17, grading 12.99 mi. Taylor Co. Noted Mar. 12.

Wisconsin — State Hy. Comn., Milwaukee, grading, concrete paving 4.033 mi. Big Foot Darien-Richmond Rd., to R. V. Birdsall & Sons, Racine, $82,000—7.0441 mi. Sect. 1 and 10.0689 mi. Sect. 2, Waupun-Oshkosh Rd., to J. R. Griffith, Racine, and $207,038 and $271,559 respectively — 10 mi. Fausau-Aniwa Rd., to Kramp Constr. Co., Berlin, $212,722—3.976 mi. Friendship-Nekoosa Rd., to Rapids Constr. Co., Wisconsin Rapids, $77,454—11.2 mi. Plainfield-Wautoma Rd., to N. M. Isabella, Madison, $248,456—5.42 mi. Glideen-Morse Rd., to Nelson, Mullen & Nelson, 355 Gateway Bldg., Minneapolis, Minn., $45,570 — 9.242 mi. New Auburn-Rice Lake Rd., to V. Nelson, Superior, $202,802, all foregoing in Walworth, Fond du Lac, Marathon, Wood, Waushara, Barron and Ashland Counties—also 0.2 mi. Eau Claire River Bridge, approaches, Marathon Co., to Wausau Iron Wks., Wausau, $57,781. Grand total $1,405,382. Noted Mar. 19.

Wisconsin—State Hy. Comn., Milwaukee, to A. W. Gallagher & Son, Madison, graveling 7 mi. County Trunk Hy. $2,730—to G. Kivlin, Madison, 1.5 mi. County Trunk Hy., $696—to C. M. Straavaldsen, Madison, grading 2.25 mi. County Job 610-32, Vienna Twp., $2,768—to F. C. Raemisch, Waunakee, 0.76 mi. County Job 611-32, Town of Vienna, $1,151; 2.27 mi. Job 508-11, $3,280—to E. F. Gallagher, Oregon, Town of Vienna Rd., Job 612-32, $21,172; 4 mi. County Trunk P-B, $800; County Trunk B-AB, $1,750; County Trunk D and M, $350; County Trunk G, $1,080; 0.8 mi. S.T.H. 92, $510—to P. Covleigh, Reedsburg, 2.27 mi. Job 580-11, Dane, $1,425—to J. S. Karlslyst, Stoughton, 7 mi. S.T.H. 73, $2,345—to Overgaard & Weiss, London, 1.26 mi. Town Rd., Vienna, $1,058; 0.76 mi. County Job 611-32, $620; 2.25 mi. County Job 610-32, $1,890—5.25 mi. County Trunk E and K, $1716; 2.75 mi. Trunks V and D-M, $1,070; 10 mi. State Trunk Hy. 113, $3,600. Grand total $30,921. Noted Mar. 19.

Ontario—A. A. Smith, deputy minister Dpt. Hys., Parliament Bldgs., Toronto, concrete paving 7 mi. Belle River Hy. W., Contr. 31-03, to Canada Paving & Supply Corp., East Windsor—4 mi. Exeter Hy. S., Contr. 31-06, to Boss & Brazier, Woodmen of the World Bldg., London—7 mi. Walkerton Hy. W., Contr. 31-09, to Johnson Bros., 43 Market St., Brantford—5.5 mi. Arthur Hy. W., Contr. 31-10, to Bergmann Constr. Co., 128 King St. N., Waterloo—6 mi. Orangeville Hy. W., Contr. 31-11, to Archibald & Birdsall, 350 Bay St., Toronto—5 mi. Orillia Hy. S., Contr. 31-12, to McNamara Constr. Co., 53 Yonge St., Toronto—7 mi. Barrie Hy. N. and W., Contr. 31-13, to King Paving Co., Oakville—5 mi. Omemee Hy. W., Contr. 31-14, to A. E. Jupp Constr. Co., 170 Berkeley St., Toronto—mixed macadam paving 6 mi. Guelph Hy. E., Contr. 31-17, to Godson Contg. Co., 203 Richmond St., W., Toronto—7 mi. Mount Elgin Hy. N., Contr. 31-20, to Canada Paving & Supply Constr. Corp., East Windsor—8 mi. Mount Forest Hy. N., Contr. 31-21, to Dufferin Paving & Crushed Stone Ltd., foot of Bathurst St., Toronto—grading, culverts, 8 mi. Wingham to Teeswater Hy., Contr. 31-23, to Wingham Constr. Co., Wingham. Noted Feb. 5.

Ont., Belleville — Hastings Co., gravel or crushed stone resurfacing 200 mi. hy., 70 corrugated steel culverts, 2 concrete culverts, day labor. $175,000. S. H. Fox, Madoc engr.

Ont., Chatham—Kent Co., grading, graveling, resurfacing, drainage structures on roads, day labor. $154,600. W. D. Colby, Harrison Hall, engr.

Ont., Hamilton—Concrete curbing, guttering, asphalt on concrete paving Maple Ave., Fullerton and Birmingham Sts., day labor. $28,700. W. L. McFaul, City Hall, engr.

Ont., London—Middlesex Co., grading, culverts, drainage structures, resurfacing roads during year, day labor. $120,000. C. Talbot, County Bldgs., London, engr.

EXCAVATION, DRAINAGE, IRRIGATION, LEVEES, RIVER AND HARBOR

PROPOSED WORK

Mass., Falmouth—Town. A. Underwood, chn. Bd. Selectmen, rip rapping, grading. Herring River. $25,000.

Mass., Woburn—City, School Comn., drainage grading about Junior High School grounds to take care water flood problem. $25,000 W. H. Punchard, 19 Arlington St., Boston, landscape archt.

Washington—King Co. (Seattle) and Pierce Co. (Tacoma) improving White River, extension for 10 mi., from Auburn to Buckley $150,000. T. D. Hunt, engr. King Co., Seattle

BIDS ASKED

Ind., Fowler—Apr. 17, by Bd. Comrs. Benton Co., Lenck Ditch, 21,000 ft. long, incl 118,468 cu.yd. dry earth excav. $25,000. D Heaton, Fowler, engr.

Ind., Marion—Bd. Comrs. Grant Co. taking bids Taylor Creek Ditch, 36,800 ft. long, also branches 7,035 ft. long, incl. 74,084 cu.yd. excav. $26,000. A. Conner, Marion, engr.

Massachusetts—Apr. 14, by Dpt. P. Wks., State House, Boston, dredging 45,000 cu.yd. material, 2 acres Lake Anthony, 6 and ft. mean low water in Oak Bluffs—77,000 cu.yd. material Green Harbor, hydraulic process, 6 ft. mean low water, Marshfield—20,000 cu.yd. material, 4 acres Manchester Harbor, 6 and 8 ft. mean low water, Manchester. A. W. Dean, Dpt. P. Wks., Boston, engr.

N. Y., Brooklyn—Apr. 16, by M. Cosgrove, comr. Docks, Pier "A", Battery Pl., North River, New York, bulkhead wall at Mill Basin, Contr. 1948.

N. Y., Brooklyn—Apr. 17, by M. Cosgrove, comr. Docks, Pier "A", Battery Pl., New York, removing old structures, building bulkhead platform, with wall, placing dry fill, dredging and disposal of dredged material as fill, bulkhead wall between West 30th and West 37th Sts., Gravesend Bay, Brooklyn Boro, Contr. 1998.

N. Y., Syracuse—Apr. 14, by New York Central R.R., F. B. Freeman, ch. engr., New York 300,000 cu.yd. fill on area to be occupied by Peat St. Yards, for Grade Crossing Comn., State Tower Bldg.

Tex., Brownsville—Apr. 21, by Cameron Co. Water Improv. Dist. 14, at office L. P. Stover, pres., irrigation project, incl. furnishing reservoir site, right-of-way, cleaning present canals, building new canal lines, new pumping unit, etc. W. E. Anderson, San Benito, engr.

Tex., Ohuito—Milwaukee Development Co., taking bids irrigation, drainage work, incl. installation underground irrigation and tile drainage. $40,000. Private plans.

Tex., Waco—J. Strange, city engr., and M. Hannah, engr., McLennan Co., taking bids and open same about Apr. 12, 3 mi. drainage ditch, 10 ft. deep, 20 to 30 ft. wide south of new state for City and McLennan Co. $40,000.

CONTRACTS AWARDED

Conn., Hartford—City, Bd. Contr. & Supply, constructing, raising 2 dumping bridges on storage tracks, South Meadows part of dike work, to Foundation Constr. Co., 50 State St., $5,206.

Mass., Winthrop—Metropolitan Dist. Comn., 20 Somerset St., Boston, repairing break in sea wall and section pavement, concrete, opposite Ocean Ave., to M. McDonough, Saugus, $20,730. Est. $25,000. Noted Mar. 26.

N. J., Trenton—Bd. City Comrs., City Hall, 1,200 lin.ft. bulkhead along Delaware River, for Marine Terminal, to Karno-Smith Co., Inc., Broad St. Bank Bldg., $166,325. Noted Feb. 5.

Ont., Toronto—Toronto Harbour Comrs., J. G. R. Wainwright, ch. engr., Harbor Comn. Bldg., dipper dredge work, 300,000 cu.yd., to Canadian Dredging Co. Ltd., Harbour Comn. Bldg. Est. $100,000.

Bond Elections

Coming Bond Elections

Waterworks—Spring Hill, La., Apr. 14. $35,000.
Bridges—Napa, Calif., $52,000.
Power Distribution System—De Soto, Mo., April, $95,000. E. L. Dillon, St. Louis, engr.
Natural Gas System—Wellington, Tex., Apr. 8, $80,000. C. C. Knight, Wellington, engr.
Swimming Pool—Fairbury, Neb., Apr. 7, $25,000.
Power Plant—Grand Junction, Colo., Apr. 7, $750,000. Word & Weber, Denver, Engr.
Schools—Springfield, Ill., May 5, $375,000.
High School—Manlius, N. Y. Dist. 11, Apr. 24, $424,000.

Bonds Voted

Waterworks Impvts.—Hot Springs, Mont., $30,000.
Sewers—Slidell, La., $40,000.
Bridge—Homestead, Pa., Allegheny Co. $3,000,000. V. R. Covell, Pittsburgh, engr.
Municipal Golf Links—Phoenix, Ariz. $100,000.
Schools—Los Angeles, Calif. $12,720,000.
School—Charles City, Ia., $250,000.
High School—Marathon, N. Y. $275,000.

Bonds Defeated

Waterworks—Globe, Ariz., $150,000.
Storm Sewers—Springfield, Mo., $700,000.
Schools—Sioux City, Iowa, $700,000.

FEDERAL GOVERNMENT

PROPOSED WORK

Ark. and Tex., Texarkana—POST OFFICE—Treas. Dpt. at office Sup. Archt., soon takes bids 2 or 3 story, rein.-con., brick, stone, State Line between 5th and 6th Sts. $790,000. Noted May 23.

Calif., Long Beach—FEDERAL—Treas. Dpt. at office Sup. Archt., plans by Allied Architects Assn. of Long Beach, 430 East Ocean Blvd., 2 story, basement, 135 x 199 ft., brick, steel, rein.-con., American Ave. and 3rd St. $500,000. Noted Dec. 18.

Calif., Richmond—DREDGING—U. S. Eng., Custom House, San Francisco, rejected bids Feb. 5, 523,000 cu.yd. in Richmond Harbor. Noted Jan. 15.

Fla., Jacksonville — POST OFFICE, etc. — Treas. Dpt. at office Sup. Archt., bids about July. U. S. Post Office and Parcel Post Building, H. J. Klutho, 2030 Main St., archt. Noted Dec. 11.

Ia., Davenport—POST OFFICE—Treas. Dpt. at office Sup. Archt. concrete, brick, stone post office. $665,000. S. J. Temple, 710 Union Bank Bldg., assoc. archt. J. A. Wetmore, c-o owner, acting superv. archt. Noted Mar. 26.

Mass., Gloucester—POST OFFICE—Treas. Dpt. sketches by W. T. Aldrich, 30 Newbury St., Boston. W. C. Chase, assoc. archt., 8 Marlboro St., Boston, 1 story, basement post office, Franklin Sq., Pleasant St. and Dale Ave. $350,000.

Mich., Grand Island—COAST GUARD STATION—U. S. Coast Guard Ser. U. S. Coast Guard Station. $60,000.

Miss., Clarksdale — FEDERAL BUILDING — Treas. Dpt. at office Sup. Archt., sketches, brick, concrete, stone federal building addition. $150,000.

New Jersey—DREDGING—U. S. Eng., Phila., Pa., 1,915,000 cu.yd. in Delaware River between Bordentown and Trenton.

New York—COAST GUARD STATIONS—U. S. Coast Guard Serv., rebuilding and relocating Fire Island and Jones Beach Life Saving Stations. $100,000

N. Y., New York — POST OFFICE — Treas. Dpt. at office Supt. Archt., plans by McKim, Meade & White, 101 Park Ave., U. S. Post Office annex, 9th Ave. from 31st to 33rd Sts. $5,000,000. **Maturity about June 1.** Noted Dec. 25.

N. Y., Stapleton (mail Staten Island)—HOSPITAL—Treas. Dpt. at office Sup. Archt., bids about July, general contract U. S. Marine Hospital, $2,500,000. K. M. Murchison, 101 Park Ave., New York, archt. Noted Apr. 2.

O., Cleveland—RIP RAP STONE—U. S. Eng., Buffalo, N. Y., 2,500 lin.ft. rip rap stone, reinforcement along lake side west breakwater, Cleveland Harbor.

Pa., Phila.—DIKE—U. S. Eng. constructing 3rd section Pea Patch Dike, Delaware River.

Tenn., Chattanooga—POST OFFICE, etc.—Treas. Dpt. at office Sup. Archt., plans by R. H. Hunt Co., 1st Natl. Bank Bldg., post office, court house. **Maturity late in summer.** Shreve, Lamb & Harmon, 11 East 44th St., New York, assoc. archts.

Texas—DAMS and FLOOR CONTROL—International Water Comn. of Rio Grande River, M. B. Moore, secy. American Section Wash., D. C., dams and flood control work on Rio Grande River for irrigation projects. S. F. Crecelius, San Benito, engr. C. F. Keeler, asst. engr. Noted Mar. 26.

T. H., Oahu—AMMUNITION DEPOT—Yards & Docks soon takes bids developing naval ammunition depot, incl. 131 buildings, 11.5 mi. railroads, paving, electrical, telephone and water supply systems.

BIDS ASKED

Ala., Montgomery—QUARTERS—May 1, by Con. Q.M., Maxwell Field, 3 double sets non-commissioned officers quarters at Maxwell Field; adv. E. N.-R. Apr. 9.

California — BRIDGE — Apr. 21, by C. H. Sweetser, dist. engr. Pub. Rds., 461 Market St., San Francisco, bridge over south fork Merced River, grading approaches on Sect. B2, Route 2, Wawona Rd. and bridge over Big Creek, grading approaches on Sect. B, Route 47, Oakhurst Natl. Forest Hy., Sierra Natl. Forest, Mariposa Co.

Calif., Oakland—POST OFFICE, etc.—May 5, by Treas. Dpt. at office Sup. Archt., superstructure (except elevators) U. S. Post Office, Custom House. $1,500,000.

Calif., San Francisco—QUARTERS—Apr. 16 (extended date), by Con. Q.M., Fort Mason, fifteen sets 2 story, basement, brick, non-commissioned officers quarters, San Francisco, Presidio. Former bids returned unopened. Noted Mar. 12.

Calif., San Francisco—HOSPITAL—Apr. 30, by Con. Q.M., Fort Mason, 3 story, rein.-con. and 2 story, rein.-con. ward additions to Ward F-1 and Wards 10 and 11, Letterman General Hospital, San Francisco Presidio. Noted Mar. 19.

Conn., Milford—POST OFFICE—May 4, by Treas. Dpt. at office Sup. Archt., U. S. Post Office; adv. E. N.-R. Apr. 9.

D. C., Wash.—CRANE—Apr. 21, by A. L. Flint, purch. officer Panama Canal, overhead traveling electric crane, Schedule 2645.

D. C., Wash.—EXTENDING, etc.—Apr. 22, by Treas. Dpt. at office Sup. Archt., extending, remodeling U. S. Dpt. Agriculture Power House; adv. E. N.-R. Apr. 9.

D. C., Wash.—HOSPITAL—Apr. 30, by Dpt. Interior, Tuberculosis Building 1, roads, etc.

Fla., St. Augustine—KITCHENS, etc.—Apr. 16, at office U. S. Property & Disbursing Officer, 8 kitchens, mess buildings, 78 tent floors, repairing 20 mess buildings, at Camp J. Clifford R. Foster.

Illinois—METAL WORK—May 4, by U. S. Eng., 1st Chicago Dist., metal work at Dresden Island Lock and Dam, in Illinois River; and Brandon Rd. Lock and Dam, Des Plaines River; adv. E. N.-R. Apr. 9.

Ill., Chicago—POST OFFICE—Treas. Dpt. at office Sup. Archt., bids about Apr. 15, U. S. Post Office, Cana St. between Harrison and Van Buren Sts. $22,000,000. Graham, Anderson, Probst & White, 80 East Jackson St., archts. Noted Mar. 5.

Ind., Fort Wayne—POST OFFICE, etc.—May 1, by Treas. Dpt. at office Sup. Archt., 3 story, basement, 150 x 180 ft., brick, limestone, post office and federal building, Harrison, Webster, Douglass and Brackenridge Sts. $550,000; G. Mahurin, 425 Standard Bldg., archt. B. Morris, 101 Park Ave., New York, consult. archt.

Ind., South Bend—POST OFFICE—June 1, by Treas. Dpt. at office Sup. Archt., 3 story, basement, rein.-con., Jefferson and Main Sts. $900,000. Austin & Shambleau, 1201 Bldg., Tower, archts. Noted Dec. 11.

Ind., Lafayette—POST OFFICE—Treas. Dpt. at office Sup. Archt., bids about July 1, general contract 2 story, basement, rein.-con., limestone, $315,000. W. Scholer, Lafayette, archt. Noted Feb. 19.

Maryland—DREDGING—May 5, by U. S. Eng., 300 Custom House, Baltimore, 99,056 cu.yd. in Broad Creek River, 65,187 cu.yd. in Corsica River, and 16,663 cu.yd. in Kent Island Narrows; adv. E. N.-R. Apr. 9.

Mass., Winthrop—RADIO HOUSE—Apr. 15, by Treas. Dpt. at office Sup. Archt., 1 story radio house, for U. S. Coast Guard, Fort Heath. Noted Mar. 26.

Mo., Jefferson City—REVETMENT—Apr. 24, by U. S. Eng., 707 Postal Telegraph Bldg., Kansas City, 2,400 lin.ft. standard revetment in Missouri River, Burray's Bend, 3.6 mi. up-stream from here.

Mo., Robertson—LATHE—Apr. 14, by Bureau Supplies & Accounts, tool room lathe to Naval Reserve Aviation Base.

Montana — ROAD — Apr. 24, by Pub. Rds., Missoula, reconstructing, surfacing 11.5 mi. Smet Essex Sect. Columbia Falls, Glacier Park Forest Rd., Flathead Co.

Neb., Fort Cook—SWIMMING POOL—See "Contracts Awarded."

Nev., Boulder City—WATER SUPPLY LINE—Apr. 13, by Bureau Reclamation, Las Vegas, 10 and 12 in. high pressure water supply line, R. F. Waller, Denver, Colo., engr. W. Young, Las Vegas, resident engr. Owner furnishes pipe.

N. Y., Brooklyn—CABLE—Apr. 17, by Signal Supply Officer, Army Base, 58th St. and 1st Ave., cable.

N. Y., Lyons—POST OFFICE—Apr. 24, by Treas. Dpt. at office Sup. Archt., U. S. Post Office; adv. E. N.-R. Apr. 9.

Pa., Chambersburg—POST OFFICE—Apr. 24, by Treas. Dpt. at office Sup. Archt., U. S. Post Office.

R. I., Newport—BAND SAW—Spec. 5484—Apr. 21, by Bureau Supplies, Navy Dpt., one 36 in. band saw, motor driven.

Va., Langley Field—HOSPITAL—May 5, by Con. Q.M., Fort Monroe, hospital at Langley Field; adv. E. N.-R. Apr. 9.

Wis., Milwaukee—AIR COMPRESSORS—Apr. 22, by Treas. Dpt. at office Sup. Archt., at U. S. Post Office.

Wis., Ashland—REMODELING—Apr. 30, by Treas. Dpt. at office Sup. Archt., remodeling, extending U. S. Post Office; adv. E. N.-R. Apr. 9.

Wyo., Sheridan—POST OFFICE—Apr. 27, by Treas. Dpt. at office Sup. Archt., U. S. Post Office.

CONTRACTS AWARDED

Arizona—ROAD—Pub. Rds., 508 Ellis Bldg., Phoenix, grading, draining 2.915 mi. Oak Creek Forest Hy., Cucumino Co., to H. Galbraith, Jerome, $58,372. Noted Mar. 5.

Ariz., Tucson—HOSPITAL—Vet. Bu., Arlington Bldg., U. S. Veteran's Hospital, to Orndorff Constr. Co., 437 South Hill St., Los Angeles, Calif., $248,200. Noted Feb. 19.

California—ROAD—C. H. Sweetser, dist. engr. Pub. Rds., 461 Market St., San Francisco, grading 6.246 mi. Sect. A, Route 76 Maricopa-Ventura Natl. Forest Hy., Ventura Co., to Merritt, Chapman Scott, San Pedro, $364,329. Noted Mar. 5.

Calif., Riverside—QUARTERS—Con. Q.M., 2 field and 8 company officers-quarters at March Filed, to DeCamp-Hudson-Seckels, Inc., 1227 West 24th St., Los Angeles, $111,365. Noted Feb. 26.

Calif., San Diego—PUMPS, etc.—Spec. 6426—Yards & Docks, Navy Dpt., pump and fire protection, to M. H. Golden & Co., California Bank Bldg., $27,255. Noted Mar. 15 Daily.

Calif., San Diego—STORE HOUSE—Spec. 6407—Yards & Docks, Navy Dpt., extending storehouse to M. H. Golden & Co., California Bank Bldg., San Diego, $57,282. Noted Feb. 19.

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Federal Government (Continued)

Fla., Jacksonville—WAREHOUSE—U. S. Eng., warehouse and storage shed addition, to R. E. Spaulding, Hildebrandt Bldg. Est. $25,000.

Fla., Pensacola—GRADING—Spec. 6424—Yards & Docks, Navy Dpt., grading, paving Corry Field, to Smith Eng. & Constr. Co., Jacksonville, Fla., $31,949. Noted Mar. 12.

Idaho — ROAD — Pub. Rds., Ogden grading, graveling, 26.762 mi. Salmon-Montana State Line Natl. Forest Rd., Lemhi Co., to O. Nelson, Logan, Utah, $69,985. Noted Mar. 12 Daily.

Ill., Carbondale—POST OFFICE—Treas. Dpt. at office Sup. Archt., U. S. Post Office, to H. A. McGuire & Co., Dermon Bldg., Memphis, Tenn., $68,713. Noted Feb. 19.

Ill., Mound City—PUMP HOUSE, etc.—Con. Q. M., 6th Corps Area, 1819 Pershing Ave., Chicago, pump house, pump, general utility building, to E. Stephens, Mount Carmel, $5,280.

Ill., Rock Island — LOCKS — U. S. Eng., Federal Bldg., 2 parallel locks at Lock and Dam 15, Mississippi River, to Merritt, Chapman & Whitney Corp., Alsworth Bldg., Duluth, Minn., $1,326,472. Noted Feb. 26.

Ind., Fort Benjamin Harrison—CLUB—Con. Q.M. service club, to Amer. Constr. Co., 1219 Georgia St., Indianapolis, $33,890. Noted Feb. 19.

Kan., Pittsburg—POST OFFICE—Treas. Dpt. at office Sup. Archt., extending, remodeling U. S. Post Office, to W. Peterson, 300 Wilkinson Bldg., Omaha, Neb., $60,900. Noted Feb. 26.

La., New Orleans—QUARTERS—Treas. Dpt. at office Sup. Archt., one 3 story nurses' quarters, one 3 story officers' quarters and six double residences for physicians, Henry Clay Ave., to R. P. Farnsworth & Co., Maritime Bldg., $299,974. Noted Mar. 5.

Md., Fort Meade—QUARTERS—Con. Q.M., Fort George G. Meade, 14 sets company officers quarters, to J. M. Kisner & Bros., Lumber Co., Fairmont, Va., $168,546. Noted Feb. 19.

Mass., Chelsea — HOSPITAL — Spec. 6430 — Yards & Docks, Navy Dpt., 3 story, basement naval hospital addition, to Frankini Bros., Inc., 30 Mystic Ave., Medford $121,275. Noted Apr. 2.

Neb., Fort Crook—SWIMMING POOL—Con. Q.M., 40 x 120 ft. swimming pool, sand filter, circulating pump and chlorinator, day labor, $11,000.

New Jersey — DREDGING — U. S. Eng., 39 Whitehall St., New York, 644,000 cu.yd. material in Newark Bay and Hackensack River to Standard Dredging Co., 233 Bway., New York, at $0.33 per cu.yd. (unofficial).

Tenn., Memphis—BOILER HOUSE—Vet. Bu., Arlington Bldg., boiler house, garage, chimney, to Harrison-Wright Co., 4 West 3rd St., Charlotte, N. C., $88,944. Noted Mar. 5.

Tex., Huntsville—POST OFFICE—Treas. Dpt. at office Sup. Archt., U. S. Post Office, to Sanford Bros. 301 Washington St., Montgomery, Ala., $59,792. Noted Feb. 19.

Tex., Randolph Field — QUARTERS — Con. Q.M., 11 field officers quarters, to Bellows MacLay Constr. Co., Construction Bldg., Dallas, $148,783. Noted Feb. 19.

Tex., Randolph Field — QUARTERS — Con. Q.M., 7 company officers quarters, to G. E. Wieland, 106 East 25th St., Austin, $78,568. Noted Feb. 19.

Utah—ROAD—Pub. Rds., Ogden, grading, surfacing 8.351 mi. Widlsoe-Bryce Natl. Forest Road, Powell Natl. Forest Park, Garfield Co., to O. Bundy, Ogden, $47,190. Noted Mar. 12.

Va., Langley Field—SEWAGE PLANT—Con. Q.M., Fort Monroe, sewage disposal plant, Lighter-than-Air Section, Langley Field to Virginia Eng. Co., 1st Natl. Bank Bldg., Newport News, $15,890. Noted Feb. 12.

Washington — ROAD — Pub. Rds., Portland, Ore., surfacing 5.309 mi. Mount Rainier Natl. Park Roads, Pierce Co, to H. G. Johnson, Portland, Ore., $54,863. Noted Mar. 20 Daily.

RAILWAYS

PROPOSED WORK

New York—Grade Crossing Comn., State Tower Bldg., Syracuse, Peat Street Freight and Team Yards, in connection with grade crossing elimination in Syracuse. $3,713,000. N. F. Pitts, Jr., Syracuse, city engr.

Texas—Atchison, Topeka & Santa Fe R.R., G. W. Harris, ch. engr., system, Chicago, Ill., surveys standard gage railway as continuation of San Angelo branch line from Sonora to Del Rio.

CONTRACTS AWARDED

New Jersey—See "Unclassified, under Camden."

Pennsylvania—Pennsylvania R.R. Co., Broad St. Sta., Phila., T. J. Skillman, ch. engr., 100,000 tons structural steel and accessories, 47,000 tons to be used for work of electrifying lines between New York and Washington, 18,000 tons for new passenger station at Philadelphia, 24,000 tons for 3 new bridges over Passaic River at Newark, N. J., also stations, platforms, viaducts, track bridges, etc.; 26,000 tons steel awarded, to American Bridge Co., Ambridge; 14,000 tons; to Shoemaker Bridge Co., Pottstown; 13,000 tons, to Ingalls Iron Wks. Co., Verona, 4,300 tons, to Mt. Vernon Bridge Co., Mt. Vernon; 4,000 tons, to Ft. Pitt Bridge Wks., Canonsburg; 34,000 tons, to McClintic-Marshall Steel Corp., Steelton and Pottstown; 4,000 tons, to Lehigh Structural Steel Co., Allentown; 1,600 tons, to Phoenix Bridge Co., Pottstown. $7,500,000.

Wyoming — Union Pacific R.R. Co., G. J. Adamson, ch. engr., 15th and Dodge Sts., Omaha, Neb., new yard office, signal tower, to Ryberg & Sorenson, Inc., Interburban Depot Bldg., Salt Lake City, Utah, $50,000.

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SUBWAYS AND TUNNELS

PROPOSED WORK

Ont., St. Thomas—City, rein.-con., steel subway under No. 4 Provincial Hy., Fingal Hill, $30,000. W. C. Miller, City Hall, engr. Noted Oct. 30.

BIDS ASKED

New York—Apr. 10, by Bd. Transportation, J. H. Delaney, chn., 250 Hudson St., New York, installing tracks, contact rail for Route 101, part of Sect. 1, Route 109, Part Sect. 1, Sects. 2, 2A, and 3 and part Sect. 4, Rapid Transit Railroad, in Church and Fulton Sts. under East River in Manhattan to foot Cranberry, High, Jay and Smith Sts., to vicinity 4th Pl., where structure changed to elevated railroad over Smith, Huntington and Jay Sts. and Gowanus Canal, to point 250 ft. east 4th Ave. in Brooklyn Boro.

GRADE CROSSINGS

PROPOSED WORK

N. Y., Syracuse—See "Railroads, under New York."

CONTRACTS AWARDED

California — State Hy. Comn., Sacramento, undergrade crossing, incl. 2 concrete abutments with wing walls, grading, bituminous treated crushed gravel on crusher run surfacing 1,000 lin.ft. approaches, 20 ft. wide, under Southern Pacific R.R. at New England Mills, Placer Co., to W. H. Hauser, 3028 East 17th St., Oakland, $32,521. Noted Feb. 26.

DAMS

• PROPOSED WORK •

Ia., Tipton—Iowa Railway & Light Corp., Security Bldg., Cedar Rapids, preliminary surveys dam across Cedar River, Cedar Co., near here. J. D. Wardle, c/o owner, engr.

PIERS AND WHARVES

CONTRACTS AWARDED

Conn., East Hartford (br. Hartford) — WHARF, etc. — Texas Oil Co., 31 St. James Ave., Boston, Mass., constructing wharf, barrel run, dredging, elevator to facilitate marine distribution of oil products, to Merritt, Chapman & Scott, 292 Pequot Ave., New London.

AIRPORTS

PROPOSED WORK

Mo., Kansas City—National Air Transport Co., 5936 South Cicero St., Chicago, Ill., municipal hangar. $80,000. Private plans.

Pa., Pittsburgh — Bd. Comrs Allegheny Co. revised plans hangars, administration and garage buildings at airport. $252,000. Former bids rejected. Noted Mar. 5.

BIDS ASKED

N. Y., Brooklyn—Apr. 13, by M. Cosgrove, comr. Dpt. Docks, Municipal Bldg., preparing areas for parking motor vehicles, incl. furnishing, installing wire mesh fencing at Municipal Airport (Floyd Bennett Field), Flatbush Ave., Contr. 2038.

CONTRACTS AWARDED

O., Akron—Bd. Control, circle and new terminal building approaches at municipal airport, to M. B. Guran Contg. Co., Akron Saving & Loan Bldg., $25,979. Est. $25,000.

GRAIN ELEVATORS

CONTRACTS AWARDED

Ind., Indianapolis — GRAIN ELEVATOR — Acme-Evans Co., 852 West Washington St., general contract 50 x 80 ft. grain elevator, 120 ft. high, to C. J. Wacker, 142 West 3rd St. Est. $65,000.

Mo., Kansas City—GRAIN ELEVATOR—Missouri-Kansas-Texas R.R. Co., F. Ringer, ch. engr., Railway Exch. Bldg., St. Louis, 1,000,000 bu. grain elevator, rein.-con., incl. head house, conveyor system, Mill St. and Southwest Blvd., to James Stewart Corp., 343 South Dearborn St., Chicago, Ill. Est. $250,000.

POWER AND LIGHTING

PROPOSED WORK

Mo., De Soto—Postponed election until some time in April, $95,000, electric power distribution system. E. L. Dillon, 702 Wainwright Bldg., St. Louis, engr. Noted Mar. 26.

N. J., Hackensack—Hackensack Impvt. Comn., Municipal Bldg., police and fire alarm systems in conduits in widened section Main St., from Salem to Passaic Sts. $50,000. **Maturity probably soon.** Campbell, city engr.

Oklahoma—See "Unclassified."

Okla., Guthrie Center—Western Service Corp., Oklahoma City, granted franchise natural gas system. $250,000. Private plans.

Okla., Nowata — Surveys municipal gas system. $45,000. G. Roberts, Tulsa, engr.

BIDS ASKED

Ont., London—City Gas Co., W. Duffield mgr., bids about May 1, new gas holder, laying larger mains, also plans overhauling, modernizing part of equipment. $250,000. Private plans.

CONTRACTS AWARDED

Mass., Barnstable—Cape Cod Gas Co., Hyannis, illuminating gas plant, adjoining New York, New Haven & Hartford R.R. yards, to J. H. Burke, 221 High St., Wareham. Est. $25,000. Noted Feb. 19, under Factories and Mills."

Vt., Bennington—Twin City Gas & Electric Co., 131 State St., Boston, Mass., 15 mi. high tension transmission line. Owner builds. H. L. Durgin, 131 State St., Boston, Mass., engr.

PARKS AND SPORTS

PROPOSED WORK

Ariz., Phoenix—City Comn. municipal golf links. $100,000 bond election soon for same. W. J. Jamieson, Phoenix, engr.

Conn., Middletown—Wesleyan University, Bd. Trustees, alumni athletic building, 160 ft. square, clearance 45 ft. centre, incl. 75 ft. swimming pool, university grounds. $125,000 funds.

Mass., Brookline—Town, Park Comn., soon takes bids 2 story, brick, stone field house, Pudderham Playground. $72,000. Kilham, Hopkins & Greeley, 9 Park St., Boston, archts. Noted Dec. 25.

Mass., Whitman—Town, W. Brennan, chn. building com., rein.-con., steel, public swimming pool, 3 to 9 ft. deep, locker rooms. $25,000.

N. J., Edgewater—Bd. Boro Council, Boro Hall, playground, incl grading, sodding, tennis courts, slides, swings and landscaping, adjacent to Municipal Building. $25,000. **Maturity probably soon.** W. Delehanty, boro engr.

N. J., Lyndhurst (br. Rutherford)—Bd. Town Comrs., Town Hall, park, incl. grading, sidewalks, mains, landscaping, memorial and fence. $25,000. V. Hutten, 34 Van Riper Ave., Rutherford, engr.

N. J., Union City—Hudson Co. Park Comn., 921 Bergen Ave., Jersey City, improving Washington Park, incl. wading pool, grading, playground equipment, Bergenline Ave. $35,000. **Maturity probably soon.**

Okla., Tulsa—Tulsa State Fair Bd., County Court House, soon takes bids enclosing present 100 x 684 ft. grand stand with stone walls for exhibition rooms and adding roof over part of grandstand, Fair Grounds. $175,000. Rush. Ediacott & Goff, 604 Wright Bldg., archts.

Vt., Rutland—Knights of Columbus Council 232, P. P. Leamy, pres., plans by Pember & Demers, 126 Washington Ave., Albany, N. Y., 2 story, brick, concrete gymnasium addition to community building.

BIDS ASKED

Ind., Indianapolis — Apr. 14, by Indiana Agricultural Bd., State House, 122 x 598 ft., concrete, rein.-con., steel grandstand, 12,000 seating capacity, at Fair Grounds. $225,000. Koff & Deery, 620 Indiana Pythian Bldg., archts.

CONTRACTS AWARDED

Mass., Revere—C. D. Russo, 407 Revere St., 1 story, brick, timber skating rink, concrete found., 658 Ocean Ave., to Yantosca & Russo, 407 Revere St. Est. $25,000.

N. J., Linden—Bd. City Council, City Hall, general contract tile, concrete swimming pool, frame bathhouse at Russell Wheeler Park, to Perth Amboy Constr. Co., 61 Madison Ave., Perth Amboy, $22,530; plumbing for bathhouse, to C. Nichols & Co., Hillside, $2,572; plumbing for swimming pool and heating for bath house, to A. Arace & Sons, 640 3rd Ave., Elizabeth, $8,360 and $380 respectively. Grand total $33,878. Noted Feb. 5.

N. Y., Brooklyn—Park Bd., W. R. Herrick, pres. Park Dpt., Arsenal Bldg., New York, demolishing and constructing new wagon shed in shop buildings group, Prospect Park, to F. A. Regan Constr. Co., 1008 4th St., $10,640; fence Metropolitan Ave. to W. B. Brown, Jr., 20 Fulton Ave., Atlantic Beach, $1,083; grading adjacent Baisley Blvd. and Lake St., to Paul West Co., 12 Lincoln Ave., Jamaica, $3,600; repaving walks, constructing benches in Grand Army Plaza, to Booth Constr. Co., 125 Court St., $9,770; constructing walks, benches on Ocean and Flatbush Aves., to C. Bennett Impvt. Co., 465 Fenimore Ave., $18,745. Grand total $43,838. Noted Mar. 5.

N. Y., New York—Park Bd., W. R. Herrick, pres. Park Dpt., Arsenal Bldg., Central Park, constructing walks, Morningside Park, to C. D. Beckwith, Inc., Seneca Ave. and Edgewater Rd., $16,683; constructing field office, Riverside Park, to Barash & Diamond, 60 Bergen St., Brooklyn, $6,748. Noted Mar. 19.

Pa., Pittsburgh — Bd. Educ. Peabody High School, Athletic Field, grading, alterations to steel bleachers, to Monaghan & Barr, 4800 Pennsylvania Ave., $44,164. **Est. $75,000.**

HEATING AND VENTILATING

PROPOSED WORK

N. J., Bound Brook—Bakelite Corp., 247 Park Ave., New York, soon lets contract heating system in 12 factory buildings, between Reading R.R. and River Rd. $25,000. Francisco & Jacobus, 511 5th Ave., New York, engrs.

BIDS ASKED

N. Y., Brooklyn—Apr. 21, by W. C. Martin, archt. and supt. School Buildings, Flatbush Ave. extension and Concord St., heating, ventilating, plumbing, drainage, electrical work and fixtures for Brooklyn Technical High School, DeKalb Ave., from Fort Greene to South Elliott Pls.

CONTRACTS AWARDED

R. I., Portsmouth—Portsmouth Priory School, S. W. Knowles, pastor, heating in dormitory, Corey's Lane, to Fall River Boiler Wks., 287 Danforth St., Fall River, Mass., plumbing, to W. Kennedy, 61 Bank St., Fall River; electrical work, to Scannevin & Potter, 250 Thames St., Newport. Est. $25,000. Noted Mar. 12.

UNCLASSIFIED

PROPOSED WORK

Ariz., Coolidge—COTTON COMPRESS—Arizona Compress & Warehouse Co., 13th and Jackson St., Phoenix, cotton compress, timber and steel. $100,000.

Mass., Boston—ESCALATOR—Boston Elevated Ry. Co., Park Eq. Bldg., new single file, cleat step type escalator at Forest Hills Station. $47,600. Private plans.

N. Y., Elmira—BULK OIL STATION—Sun Oil Co., 1608 Walnut St., Phila., Pa., bulk oil distribution, tank farm. To exceed $75,000. **Maturity after May 1.** Private plans. Noted Apr. 2.

N. Y., New York—ELEVATOR—W. F. Chales, 369 Lexington Ave., plans by L. F. Knust, 369 Lexington Ave., elevator fireproof doors for clinic, 363 Lexington Ave. $40,000.

N. Y., New York—STABLES—Riverside Ice Co., 434 East 92nd St., plans by H. C. Severance, 36 West 44th St., 2 story stables, incl. riding academy. $40,000.

Oklahoma — GAS PIPE LINE — Cimarron Utilities Co., Guyman Okla., 53 mi. 5½ in. 250 lb. gas transmission line from their wells near Guyman to Boise City; also complete intermediate pressure distribution system in Boise City. L. J. Roberts, asst. genl. mgr.

Texas—OIL PIPE LINE—Moody-Seagraves Morgan Co., Esperson Bldg., Houston, and San Antonio, and Gulf Pipe Line Co., subsidiary, Gulf Bldg., Houston, and San Antonio, 200 mi. 12 in. o.d. screw joint, bell, oil pipe line from Rusk-Gredd Co. lines (East Texas) to Tidewater outlet on Neches, near Beaumont. $500,000. Plans about complete, action deferred in letting of contracts, pending legislation disposal now before State Legislature, relating to oil business.

Texas and New Mexico—TELEPHONE EXTENSIONS—Mountain States Telephone Co., c/o F. E. Farwell, mgr., El Paso, Tex., improving, extending telephone system in El Paso Co., Texas, and in New Mexico, incl. extensions to long distance facilities, constructing new lines, installing new equipment. $225,000. Total est. $925,000. Private plans.

Va., Martinsville—GAS PIPE LINE—N. H. Gelbert, Meadowbrook, Pa., pres. Martinsville Gas Co., Martinsville, 15 mi. gas pipe line in Henry Co.

Ont., Peterborough—CABLE and CONDUIT—Bell Telephone Co. of Canada, H. H. P. Johnston, mgr., Peterborough, installing cable and conduits. $50,000. Work will probably be done by day labor.

BIDS ASKED

N. J., Point Pleasant—BOARDWALK—Bd. Boro Council, Boro Hall, bids about Apr. 15, timber boardwalks from Water St., to Manasquan River Inlet. $25,000. R. Havens, boro engr. Noted Mar. 5.

N. Y., New York—POWER EQUIPMENT—Apr. 21, by Bd. Transportation, J. H. Delaney, chn., 250 Hudson St., furnishing, installing power equipment for portions Lines A and B, Routes 101 and 109, Independent System City-owned Rapid Transit Railroad, Manhattan and Brooklyn Boros.

CONTRACTS AWARDED

Conn., Hartford—RAZING BUILDING, etc.—State, State House, razing buildings, grading grounds at new state office building (under construction since May, 1930), to J. Henry Miller & Co., Franklin St., Baltimore, Md., $193,836. Noted May, 15, under "Public Contracts Awarded."

Ill., Atkinson—COAL WASHING PLANT—Midland Electric Coal Co., Indianapolis, Ind., K. Bigsby, local mgr., Atkinson, 1 story, 50 ft. high, 60 x 75 ft. coal washing plant, incl. conveyors, elevators, equipment, to Pittsburgh Boiler & Machine Co., Pittsburgh, Pa. Est. $200,000.

N. H., Portsmouth—HOT ASPHALT PLANT—City, C. A. Allen, supt. Dpt. P. Wks., hot asphalt plant, to Dance & Co., Bway., Cambridge, Mass. Est. $40,000.

N. J., Camden—TERMINAL—South Jersey Port Comn., U. S. Jeffreys, secy., 106 Market St., railroad sidings, concrete roadways in connection with new terminal Front St. between Clinton and Pine Sts., on Delaware River, to E. F. Verga, Bway. and Cooper St., $77,736. Noted Mar. 12 under "Warehouses."

Texas—PIPE LINE—Magnolia Petroleum Co., Magnolia Bldg., Dallas, and Caroline St., San Antonio, 7,000 tons steel pipe for 70 mi. pipe line in East Texas, Kilgore Dist., to Jones & Laughlin Steel Corp., Ross St., Pittsburgh, Pa.

Texas and Louisiana — GAS PIPE LINE — Arkansas Natural Gas Co., c/o Cities Serv. Co., 60 Wall St., New York, 70 mi. 8 in. main gas pipe line with necessary branches, pumping station, between point near Longview, Tex. to Shreveport, La., to Ford, Bacon & Davis, 39 Bway., New York.

Tex., Port Aransas—OIL LOADING DOCK—Grail-Borden-Munson Co., Port Aransas, 402 ft. oil loading dock, 30 ft. wide, creosoted timber to W. Richardson, Flidell, La.; furnishing materials, to Gulf States Creosoting Co., Flidell, La. Est. $100,000.

MATERIALS

BIDS ASKED

ROAD OIL—**Merced, Calif.**—Apr. 14, by P. C. Thornton, clk. Merced Co., not less than 15,000 nor more than 30,000 bbl. processed or unprocessed road oil, pure asphalt bitumen content not less than 58% or more than 70%.

CEMENT—**Iowa**—See "Streets and Roads."

GRANITE EDGESTONES, etc. — **Cambridge, Mass.**—Apr. 10, by W. R. McMenimen, supt. Streets, City Hall, furnishing sidewalk bricks, granite edgestones (straight and circular), recut second hand granite blocks, tar, asphalt for fiscal year ending Dec. 31, 1931.

HARD FILLING—**Wakefield, Mass.** — Clark Constr. Co., 491 Main St., in market 1,000 yd. hard filling for street surfacing.

ASPHALTIC ROAD OIL—**East Orange, N. J.** —Apr. 13, by City Council, City Hall, 50,000 gal. non asphaltic road oil; 300 tons ¾ in. stone; 800 tons stone screenings. $25,000. W. Willigerod, city engr.

STEAM CINDERS—**New York, N. Y.**—Apr. 16, by H. Bruckner, pres. Bronx Boro, Crotona Park, 3rd and Tremont Aves., 40,000 cu.yd. steam cinders.

CEMENT, etc.—**Oklahoma**—Apr. 14, by State Hy. Comn., Oklahoma City, 800,000 bbl. bulk cement with provision state may increase quantity 25% and receive benefit of any decrease in market price, former bids rejected; also furnishing 10 m.g. asphalt base road oil, est. $300,000. A. R. Losh, engr.

CONTRACTS AWARDED

POLES—**Burbank, Calif.**—City Council, to H. A. Browning Lumber Co., 657 West Jefferson St., Los Angeles, twenty 35 ft. pressure treated creosoted yellow pine poles at $14 each, sixty-six 40 ft. $16.80, nine 45 ft. $20.25, eighteen 50 ft. $24, two 60 ft. $35.

STEEL PIPE—**Los Angeles, Calif.**—Bd. P. Wks., City Hall, to Crane Co., 321 East 3rd St., welded steel pipe, Spec. 2391, incl. 500 ft. 12 in. at $1.4280, 500 ft. 18 in. $1.5249, 500 ft. 24 in. $3.7344, 500 ft. 16 in. $2.082, 500 ft. 20 in. $2.844.

TAR COLD PATCH, etc.—**Baltimore, Md.**—State Roads Comn., Baltimore, G. C. Uhl., chn., 1,000,000 gal. more or less cold tar patch, to Ugite Sales Co., 1401 Arch St., Phila., Pa., $0.10 car tank and $0.10 drum; furnishing 350,000 gals. more or less penetration asphalt, to Atlantic Refining Co., 260 South Broad St., Phila., Pa., at $0.03 car tank and $0.05 drum. Noted Mar. 5.

CASTINGS and FITTINGS—**Salem, Mass.**—D. W. Hamilton, purch. agt., castings, fittings to Sewer and Water Dpts., as specified, to Leonard Iron Fdry. Co., Tulip St., at $0.0298 and $0.0398 per lb.

FIRE HYDRANTS, etc.—**St. Louis, Mo.**—Water Dpt., L. Day, comr., five hundred 2 piece hydrants, to American Fdry. Co., 11th and Hebert Sts., at $26.19, $29.19 and $30.38 each; 1,000 standard fire hydrants, to J. Fritz Fdry. & Machine Co., 2018 South 3rd St., $26.98 each.

PEA GRAVEL—**Belvidere, N. J.**—Bd. Freeholders Warren Co., 6,815 tons washed pea gravel, to Gallo Sand & Gravel Co., Neteong, at $1.60 per ton; 1,233 tons, to North Jersey Sand & Stone Co., Carpentersville, $1.50.

TAR—**Cincinnati, O.**—Comrs. Hamilton Co., 500,000 gal. Grade 1 tar for road repair work, to Barrett Co., 517 Carr St., $53,450. Est. $60,000. Noted Mar. 19.

STRUCTURAL STEEL — **Pennsylvania** — See "Railways."

BITUMINOUS MATERIAL — **Virginia** — See "Streets and Roads."

EQUIPMENT

BIDS ASKED

BOILERS—**Boston, Mass.**—Apr. 16, by Metropolitan Dist. Comn., Water Div., 20 Somerset St., 3 vertical fire-tube boilers 98 in. diam. and 24 ft. high, for working steam pressure 185 lb. per sq.in. for Commonwealth of Massachusetts.

CATERPILLAR TRACTOR—**Boston, Mass.**—Central Equipment Co., 31 State St., in market 3 or 5 ton caterpillar tractor with bulldozer attachment.

STEAM ENGINE — **Boston, Mass.** — Owner, P. O. Box 5273, in market 150 hp. steam engine, modern type.

VERTICAL MACHINE — **Boston, Mass.** — Owner, c/o P. O. Box 1658, in market Miehle vertical machine.

POWER PUNCH PRESS—**Cambridge, Mass.**—New Method Die Co., 30 Cross St., in market power punch press, 12 in. throat.

STERLING ENGINE—**Dorchester** (sta. Boston), **Mass.**—Freeport Engine Co., 450 Freeport St., in market 8 cylinder Sterling engine or similar.

VACUUM CONDENSATION PUMP—**Gardner, Mass.**—Bello Corp., in market electrically driven vacuum condensation pump for 5,000 ft. radiation.

BENCH LATHE, ENGINE LATHE, POWER PRESS, etc.—**Reading, Mass.**—Owner, c/o P.O. Box 96, in market bench lathe, engine lathe, power press, milling machine, shaper, hand screw machine and general equipment for light manufacturing.

ROAD CONTRACTORS HARROW—**Waltham, Mass.**—Cedarcrest Farm, in market road contractors harrow, A or V shape.

DOUBLE STANDARD FIRE HYDRANTS — **Detroit, Mich.** — Apr. 11, by D. Dow, comr. Purchases & Supplies, 735 Randolph St., 200 six in. D. F. D. Double standard fire hydrants, 200 six in. D. F. D. standard, double disc gate valves, for Fire Dpt.

GRADER—**Crookston, Minn.**—Apr. 15, by H. J. Welte, aud. Polk Co., 1 elevating grader.

TRACTORS and ROAD MACHINES—**Mississippi**—State Hy. Comn., Jackson, will take new bids 22 tractors, 22 road machines (graders from 4,000 lb. to 7,000 lb.) G. A. Draper, hy. engr.

TRUCKS—**Brooklyn, N. Y.**—Apr. 15, by H. Hesterberg, pres. Brooklyn Boro, Boro Hall, four 7½ ton motor trucks with dump bodies.

INCINERATORS—**New York, N. Y.**—Apr. 13, by P. J. Dooling, comr. Water Supply, Gas & Electricity, Municipal Bldg., furnishing, delivering concrete incinerators to Parks—Bronx adm Manhattan; gasoline driven road roller to Water Supply, Gas & Electricity; sprayer and tractor mower to Dpt. Parks-Richmond.

MOTOR TRUCKS—**New York, N. Y.**—Apr. 10, by S. Levy, pres. Manhattan Boro, Municipal Bldg., three 5 ton motor trucks; four 7 ton motor trucks, asphalt delivery.

ROAD GRADER — **Kingston** (Wilkes Barre P.O.), **Pa.**—Apr. 20, by Boro Council road grader, $2,000. Bidders to submit with bid a detailed specification, and what guarantee of performance of grader.

TRACTORS—**Hillsboro, Tex.**—Apr. 27, at office W. R. Brewington, aud. Hill Co., 1 or more 30 to 60 hp. crawler type tractors.

ROAD TRACTOR—**Logan, Utah**—City in market 1 road tractor. C. T. Barrett, Logan, engr. $5,500.

FOREIGN

England, Leeds—Paramount Publix Theatres, Paramount Bldg., c/o Foreign Theatres Dpt., plans theatre. To exceed $500,000. **Maturity indifinite.**

Peru—Ministry P. Wks., Lima, recommends revised concession for constructing and operating railroad from Port of Bayobar to Yurimaguas, on Huallaga River, to W. R. Davis Co., c/o United States Consulate, Lima. **Maturity about July 1.** Noted Feb. 20, 1930.

Commercial Buildings

RESIDENTIAL

BIDS ASKED

Kan., Dodge City—H. A. Hart, owner, and Southern Hotel Co., lessee, bids after Apr. 15, 10 story, basement, 97 x 222 ft., rein.-con. brick, steel hotel, Spruce and 2nd Sts. $435,000. E. Charles, Orpheum Bldg., Wichita, archts.

N. J., Jersey City—See "Contracts Awarded."

N. J., Newark—See "Contracts Awarded."

N. Y., Astoria—See "Contracts Awarded."

N. Y., Forest Hills—See "Contracts Awarded."

N. Y., Hollis—See "Contracts Awarded."

N. Y., Laurelton—See "Contracts Awarded."

N. Y., Long Island City — See "Contracts Awarded."

N. Y., New York—See "Contracts Awarded."

N. Y., St. Albans—See "Contracts Awarded."

CONTRACTS AWARDED

Calif., Calexico—Corporation, hotel, to Austin Co., 16112 Euclid Ave., Cleveland, O. Est. $400,000.

Calif., San Mateo — L. Dioguardi, 30 West Poplar St., 4 story, basement, concrete apartment, $200,000. Owner builds. W. H. Toepke, 74 New Montgomery St., San Francisco, archt.

Mass., Cambridge—Harold Realty Trust Co., 13,337 Mass. Ave., 4 story, basement, brick, plain found., 393 Bway., to S. H. Lilly, 21 Elmwood Park, Malden. Est. $150,000.

N. J., Jersey City—M. Bower, Inc., M. Bower, pres., 133 Zabriskie Ave., general contract 5 story, basement, 70 x 100 ft., brick, steel, 2011 Hudson Blvd., to Auriemma & Machi, 1765 Hudson Blvd. Est. $150,000.

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Residential (Continued)

N. J., Jersey City—New Jersey Realty Holding Co., 20 Journal Sq., 5 story, basement, 100x125 ft., brick, steel, Duncan Ave., separate contracts. $250,000. C. Shilowitz, 26 Journal Sq., archt.

N. J., Newark—Spruce Apartments, Inc., 206 Renner Ave., 3 story, basement, 50 x 175 ft., brick, steel, plain found., 59-61 Spruce St., separate contracts. $150,000. A. J. Silberstein, 104 Maple Ave., Linden, archt.

N. Y., Astoria—Kaywell Realty Corp., 215 Montague St., Brooklyn, 6 story, 90 x 100 ft., 34th Ave. and 45th St., separate contracts. $175,000. L. Bailey, 295 6th Ave., archts.

N. Y., Forest Hills—Corporation, c/o D. J. Levison, archt., 163-18 Jamaica Ave., Jamaica, 2 story, 232nd St. and South Conduit Ave., separate contracts.

N. Y., Forest Hills—H. Van Norden, 165 Bway., New York, 6 story, 76 x 214 ft., Continental Ave. and Archway Pl., to Geekie Naughton Co., 420 Lexington Ave. Est. $500,000.

N. Y., Hollis—Rodman & English, 199-16 Hollis Ave., 2 story, basement, Aterton Ave., separate contracts. $150,000. Private plans.

N. Y., Laurelton — Laurelton Homes, Inc., 160-16 Jamaica Ave., Jamaica, 2 story apartment, 225th St. and 131st Ave., separate contracts. $150,000. A. Allen, 163-18 Jamaica Ave., Jamaica, archt.

N. Y., Long Island City—Brunetti & Carnezza, 366 Queens Blvd., 6 story, 84 x 120 ft. 39th Pl. and 47th Ave., separate contracts. $175,000. L. Bailey, 295 6th Ave., Astoria, archt.

N. Y., Long Island City—Morris Corp., Chatham Phoenix Bldg., Jamaica, 6 story, 90 x 150 ft., 40th St. and 43rd Ave., separate contracts. $250,000. B. Braunstein, 163-18 Jamaica Ave., Jamaica, archt.

N. Y., New York—Academy Housing Corp., 1750 Randell Ave., 6 story, 65 x 135 ft., Commonwealth and Lacombe Ave., separate contracts. $250,000. Springsteen & Goldhammer, 40 East 49th St., archts.

N. Y., New York—Corporation, c/o A. Alkoff, 215 East 149th St., 6 story, 75 x 84 ft., Yates Pl. and Gunhill Rd., separate contracts. $150,000. A. E. Schaefer, 2408 Grand Concourse, archt.

N. Y., New York—Corporation, c/o I. Prussin, 349 East 149th St., 6 story, College Ave. and 168th St., separate contracts. $180,000. J. Bleich, 565 East Tremont Ave., archt.

N. Y., New York—J. Coursen, 151 East 81st St., 6 story, basement, 73 x 90 ft., Sedgewick Ave. and Perot St., separate contracts. $150,000. G. G. Miller, 545 5th Ave., archt.

N. Y., New York—Krumholz Bros., 2910 Wallace Ave., 6 story, 79 x 175 ft., Cedar Ave. and Fordham Rd., separate contracts. $300,000. Becker & Levy, 349 East 149th St., archts.

N. Y., New York—H. E. Mitler, Inc., 755 Park Ave., 6 story, basement, 67 x 150 ft., Webster Ave., vicinity 238th St., separate contracts. $170,000. C. Kreymborg, 2534 Marion Ave., archt.

N. Y., New York—R. Moorehead, 311 Bedford Park Blvd., 6 story, 73 x 113 ft. Marion Ave. and Bedford Park Blvd., separate contracts. $160,000. C. Kreymborg, 2534 Marion Ave., archt.

N. Y., New York—Morcol Holding Corp., 349 East 149th St., 6 story, 50 x 198 ft., College Ave. and 167th St., separate contracts. $200,000. J. Bleich, 565 East Tremont Ave., archt.

N. Y., New York—Olom Corp., A. Giordono, pres., 2922 Grand Concourse, 6 story, 84 x 100 ft., Bronx Blvd. and 213th St., separate contracts. $250,000. Paul Revere Kenkel, 311 East 161st St., archt.

N. Y., New York—Petro Constr. Corp., 1068 Waring Ave., 6 story, 64 x 134 ft., Barkers and Waring Aves., separate contracts. $175,000. M. W. Del Gaudio, 545 5th Ave., archt.

N. Y., New York—Waldash Realty Co., I. Feldman, pres., 119 West 57th St., 6 story, 36 x 182 ft., Dash Pl. and 242nd St., separate contracts. $300,000. H. Ginsburg, 205 East 42nd St., archt.

N. Y., St. Albans—West Albans Homes, Inc., 173rd St. and 111th Ave., 2 story, 174th St. and 111th Ave., separate contracts. $150,000. A. Allen, 163-18 Jamaica Ave., Jamaica, archt.

CLUBS

PROPOSED WORK

N. J., Long Branch—Newton White, c/o Warren & Wetmore, archts., 16 East 47th St., New York, will not build 2 story, basement club, Avenal Ave. and ocean front. Project abandoned. Noted Dec. 4.

N. J., Orange—H. B. Marsh, archt., 7 East 48th St., New York, soon lets general contract 3 story, basement, brick, steel building, Oakwood St. for Y.M.C.A., 148 Central Pl. $150,000. Noted Mar. 12.

Pa., Pittsburgh—Islam Grotto, W. Weberg, monarch, 18 West North Ave. N.S., soon takes bids 3 story, basement, Syrian type architecture, brick, colored terra cotta decorations, incl. auditorium, banquet hall, reception and recreational room, Montgomery Ave. E. $160,000. Geisler & Smithyman, 335 Blvd. of Allies, and Frank Harris Smart, Apollo Bldg., archts.

BIDS ASKED

Conn., Manchester—Apr. 14, by Manchester Y. M. C. A., W. A. Strickland, chn. building comm., 2 story, basement, 75 x 75 ft., and 45 x 75 ft., brick, steel, stone addition, community club and library, North Main St. $150,000. Hutchins & French, 11 Beacon St., Boston, Mass., and Architectural Bureau Y. M. C. A., 347 Madison Ave., New York, archts. Noted Mar. 19.

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CONTRACTS AWARDED

N. J., Asbury Park—I. B. P. O. E. of World, Monmouth Lodge, general contract 2 story, basement, 50 x 100 ft., brick, steel, Atkins Ave., to T. Mangeri, Hamilton. Est. $150,000. Contractor requests bids on all separate contracts.

HOSPITALS

PROPOSED WORK

Kan., Lawrence—Kansas University, c/o State Bd. Administration, State House, Topeka, H. R. Rhodes, bus. mfr., soon takes bids 3 story, part basement, sub-basement, concrete, brick, stone, university campus, $200,000. J. W. Radotinsky, State House, Topeka, archt. Excavation contract awarded to B. A. Green. Noted Nov. 13.

Mass., Worcester—Worcester Co. Comn., E. W. Glidden, Court House, plans by Frost, Chamberlain & Edwards, 390 Main St., and takes bids latter part month, sanatorium incl. 3 story, 40 x 420 ft. hospital building, 2 story, 42 x 130 ft. nurses home, 2 story, 85 x 85 ft. service building, 1 story, 80 x 85 ft. power plant, also well water system, Huntington Farm. $1,000,000. Noted Jan. 22.

N. J., Browns Mills—F. Grad, archt., 1023 Broad St., Newark, soon lets contract 4 story, basement, brick, steel, rein.-con., sanitarium and power plant for Deborah Jewish Relief Society, M. Unger, chn., 763 Broad St. $600,000. Noted Feb. 5.

N. J., Jersey City—Bd. City Comrs., Court House, revised sketches by J. T. Rowland, 30 Veterans Sq., 15 story, brick, steel, rein.-con. psychopathic hospital, Montgomery and Baldwin Sts. $150,000 or more. Noted Jan. 8.

N. J., New Brunswick—Maginnis & Walsh, archts., Statler Bldg., Boston, Mass., soon lets contract 2 story, basement, brick, steel, hospital, for St. Peter's Hospital. Est. $150,000. Noted Mar. 26.

N. Y., New York—Flower Hospital, York Ave. and 63rd St., group hospital buildings, York Ave. and 64th St. $3,000,000-$12,000,000. **Maturity early 1932.**

BIDS ASKED

Ind., Ft. Wayne—Bd. Supervs., Allen Co., bids about Apr. 15, 2 story, basement, brick, steel, stone sanitarium, 8 mi. north of here. $150,000. Leighton Bowers, 4215 Fairfield Ave., archts.

N. H., Littleton—Apr. 13, by Littleton Hospital, H. M. Eaton, pres., 3 story, 40 x 105 ft. and ell, brick, concrete, steel hospital, power house. Rich, Mathesius & Koyl, 320 5th Ave., New York, archts. C. F. Neergard, 512 5th Ave., New York, engr. Noted Feb. 19.

CONTRACTS AWARDED

Miss., Jackson—Bd. Comrs. State Hospital Removal & Impvt. Comn., 1 Type A and 4 Type B patients cottages, 2 epileptics buildings, to M. T. Reed Constr. Co., Belzoni, $269,251; 1 cottage, to Currie & Corley, Raleigh, $73,293; 1 cottage, to I. C. Garber, Medical Bldg., $73,293; dining hall and kitchen, to Ogden & Glenn, Hattiesburg, $69,150; heating, to Peters Heating Co., 121 South President St., $44,000; plumbing, to Hamilton Bros., Gulfport, **(A)** $34,846, to Davis Plumbing Co., 115 South State St. **(B)** $11,722; electric wiring, to J. P. Williams, Jackson, $7,885. Grand total $583,440. Noted Mar. 5.

Mo., St. Louis—City, c/o Bd. P. Serv., City Hall, general contract 6 story, basement, 99 x 244 ft., rein.-con., brick, steel nurses home, to Murch Bros. Constr. Co., 1855 Railway Exch. Bldg., $393,245; heating, to Auer Power Piping Co., Merchants Laclede Bldg., $34,847; electrical work, to Sunlight Electric Co., 2735 Union Blvd., St. Louis, $29,540. Grand total $457,632. Noted Feb. 19.

N. Y., Brooklyn — Evangelical Deaconess Hospital, 44 x 120 ft. hospital, to G. W. Carlson, 418 St. John Pl. Est. $150,00. Noted Jan. 15.

O., Springfield—City, brick, steel, concrete hospital to J. I. Barnes, Springfield. $829,000. Noted Mar. 5.

CHURCHES

PROPOSED WORK

Ia., Des Moines — First Church of Christ Scientist, H. Rollins, member of com., soon lets contract 2 story, basement, concrete brick, stone church, 38th St. and Grand Ave. $175,000. Proudfoot, Rawson & Souers, 810 Hubbell Bldg., archts. Noted Feb. 26.

Md., Baltimore—H. I. Kavanagh, archt., 913 North Calvert St., soon lets contract 1 story, basement, 83 x 216 ft., steel, concrete church, Old Frederick Rd. and Monastery Ave., for St. Joseph Monastery Parish, Old Freederick Rd. and Monastery Ave. $250,000.

Mass., Chilmark—Trinity Methodist Episcopal Church, J. H. Graham, pastor, Oak Bluffs, plans by Bureau of Architecture of Methodist Episcopal Church, 1701 Arch St., Phila., Pa., and soon takes bids altering and constructing 2 story, basement, brick, timber addition, incl. addition bell tower, Main Rd. $150,000.

N. J., Dunellen—First Methodist Church, Dunellen, revised plans by Poggi & Bragdon, 275 Morris Ave., Elizabeth, and A. M. Korff, assoc. archt., 203 Park Ave., Plainfield, 2 story, basement, brick, steel parish house. $200,000. Noted Feb. 5.

N. J., Jersey City—J. Ives & Chase, lessees, 521 5th Ave., New York, bids after Apr. 20, 12 story, basement, brick, steel church, apartment, Sip and Tonnelle Aves., for 1st United Presbyterian Church, W. B. Gold, pastor, 30 Tonnelle Ave. $500,000. G. G. Miller, 545 5th Ave., New York, archt. Noted Feb. 12.

N. J., Jersey City—Westminister Presbyterian Church, H. L. Wyatt, pastor, 304 Academy St., revised sketches by W. Neuman, 26 Journal Sq., 2 story, basement, brick, steel, 302-04 Academy St. $150,000. Noted Jan. 8.

N. J., Newark—Roseville Presbyterian Church, Roseville Ave., will not alter and construct addition to Sunday school, Roseville and Sussex Aves. 150,000. Project abandoned. Noted Mar. 12.

N. J., Paterson—J. S. Struyk, archt., 161 Prospect St., Passaic, soon lets general contract 2 story, basement, brick, steel church addition, Haledon Ave., for Third Reformed Church, c/o architect. $150,000.

Pa., McKeesport—German Evangelical Lutheran Congregation plans by Schwab, Palmgreen & Merrick, Koppers Bldg., Pittsburgh, and soon takes bids brick, stone church and educational building. $150,000.

BIDS ASKED

N. J., Guttenburg—W. G. Bartels, archt., 270 Main St., Hackensack, bids about Apr. 15, general contract rebuilding 2 story, basement, brick, steel, Bergenline Ave., for Little Church Over the Hill, D. R. Reese, pastor, 326 24th St. $150,000. Noted Mar. 26.

CONTRACTS AWARDED

Conn., Fairfield—St. Thomas Roman Catholic Parish, W. J. Blake, pastor, 1 story, basement, 55 x 100 ft., brick, stone parish hall, to C. W. Bossidy, 4 Sherman Court. Est. $150,000. Noted Mar. 26.

Mo., St. Louis—St. Phillip of Neri Catholic Parish, T. D. Kennedy, pastor, 5976 Durant Ave., 1 story, basement, 66 x 186 ft., rein.-con., brick, steel, church and 2 story, basement, 16 x20 ft. rectory addition, 5036 Thekla Ave., P. J. Bradshaw, archt., 718 Locust St., will build on sub-contract basis.

N. J., Elizabeth—Fanning & Shaw, archts., 49 Ward St., Paterson, general contract 2 story, basement, brick, steel chapel, to E. Dowling, 99 Garden Ave., Totowa, for Benedictine Sisters, c/o architect. Est. $150,000. Noted Mar. 5.

N. J., West Berlin—Our Lady of Mount Carmel Roman Catholic Church, B. Doyle, pastor, general contract 7 story, basement, brick, steel, to H. B. Miller, Edgewater Park. Est. $150,000.

Ont., Ottawa—Dominican Order, rebuilding 1 story, basement, concrete, stone, steel, brick church, recently destroyed by fire, to H. Dagenais, 225 St. Patrick St., for St. Jean Baptiste Church, 116 Empress St. Est. $300,000. Noted Feb. 19.

SCHOOLS

PROPOSED WORK

Ill., Decatur—Bd. Educ., C. N. Weilepp, pres., plans by Brooks, Brambhall & Dague, Decatur, Junior High School, concrete, brick, stone. $150,000 voted. Noted Feb. 19.

Kan., Bethel—Bd. Directors Wyandotte Co. Rural High School Dist. 2, soon takes bids high school on Hy. 5 between here and Wilborn. $150,000. Peterson & Almon, 509 Huron Bldg., Kansas City, archts.

Mass., South Hadley—Mt. Holyoke College, M. E. Wooley, pres., plans by G. F. Newton, 6 Beacon St., Boston, Williston Library addition. $750,000.

Mass., Weston—Cambridge School, J. R. French, headmaster, plans by Kilham, Hopkins & Greeley, 9 Park St., Boston, brick dormitory, Trapelo Rd., near West St., $150,000 or more; also altering and constructing 2 story, 60 x 100 ft., brick, timber gymnasium addition, Trapelo Rd. $25,000.

Mo., St. Joseph—Bd. Educ., bids after Apr. 2, general contract Lindburgh School, 2 story, basement, brick, steel, rein.-con., St. Joseph St. and Concord Ave. $160,000. Webb Siemens, 503 Bartlett Bldg., St. Joseph, and W. B. Ittner, Inc., Continental Life Bldg., St. Louis, archts. Noted Jan. 22.

N. J., Carteret—Bd. Educ., 39 Central Ave., 2 story, basement, brick, steel, Washington Ave. and Lewis St. $150,000. Architect not selected. Project in abeyance. Noted Mar. 12.

N. J., Englewood—Englewood School for Boys, 35 Dwight Pl., 2 story, basement, brick, steel. $150,000. **Maturity probably soon.** Architect not selected.

N. J., Freehold—Freehold Military School, A. Dungan, in charge, sketches by J. Eberson, 370 Lexington Ave., New York, 2 story, basement, brick, steel school. $200,000.

N. J., Mahwah—Bd. Educ., E. C. Lane, chn., School Bldg., sketches by A. J. Rogers, 55 West 42nd St., New York, 2 story school. $150,000. Noted Dec. 26 Daily.

N. J., Mountainview—Bd. Educ. sketches by Hacker & Hacker, 201 Main St., Fort Lee, 2 story, basement, brick, steel school. $150,000.

N. J., New Brunswick—Rutgers College, J. G. Lipman, dir. State Agricultural Experiment Station, will not build 2 story, basement soil science building, at State Experimental Farm, $150,000. Project abandoned. Architect not selected. Noted Feb. 12.

Schools (Continued)

N. J., New Brunswick—Bd. Educ., Livingston Ave., revised plans by A. Merchant, 1 Elm Row, New Brunswick, 2 story, basement, brick, steel addition to Senior High School, Livingston Ave. $250,000. Noted Dec. 11.

N. J., North Brunswick—Bd. Educ., 2 story, basement, brick, steel, Boulevard Heights Sect. $150,000. Project in abeyance. Architect not selected. Noted Mar. 12.

N. J., North Bergen—Bd. Educ., Town Hall, will not build 3 story, basement, brick, steel high school, Hamilton Ave. and Hudson Blvd. $500,000. Project abandoned. Noted Nov. 7.

N. J., Perth Amboy—Church of Our Lady of Hungary, L. Horvath, pastor, 697 Cortland St., 2 story, basement, brick, steel school, Cortland St. $150,000. V. Eck, 155 Broad St., Red Bank, archt. **Maturity probably in June.** Noted Mar. 26.

N. J., Phillipsburg—Bd. Educ., High School, Junior High School, 2 story, basement, brick, steel, rein.-con., Jersey and South Main Sts. $150,000. **Maturity about June.** Architect not selected.

N. J., Ridgewood—Bd. Educ., J. Kollmar, secy., School 1, Beech St., Junior and Senior High School, 2 story, basement, brick, steel, $150,000 or more. Fanning & Shaw, 49 Ward St., Paterson, archts. **Maturity in June.** Noted Mar. 26.

N. J., Rumson—Bd. Educ., B. H. Borden, pres., revised sketches 2 story, basement, brick, steel, rein.-con. high school, Ridge Rd. $400,000. Noted Jan. 22.

N. J., Teaneck—Bd. Educ., High School, revised sketches by Hacker & Hacker, 201 Main St., Fort Lee, 3 story, basement, brick, steel high school addition. $635,000. Noted Mar. 19.

N. J., Union City—Bd. Educ., 415 32nd St., revised sketches by J. Lugosch, 714 Bergenline Ave., 3 story, basement, brick, steel, rein.-con., school, West St. between 5th and 6th Sts. $750,000. Noted Feb. 26.

N. Y., New York—General Theological Seminary of Protestant Episcopal Church, 175 9th St., will award contract May 1 or later, 5 story, 66 x 96 ft. school, 175 9th Ave. $165,000. E. L. Tilton, 420 Lexington Ave., archt. No bids to be taken. Noted Mar. 19.

Pa., Pittsburgh—See "Contracts Awarded."

Wis., Wauwatosa—Bd. Educ. plans by Herbst & Kuenzli, archts., 653 Franklin Pl., Milwaukee, 3 story, basement, 150 x 250 ft., brick, rein.-con., Cottrell St.

BIDS ASKED

Conn., Willimantic—Apr. 27, by W. A. Sweeney, sub-con. on properties, 2 story, basement, brick high school addition, High and Prospect Sts., for Town, E. A. Case, supt. schools. $150,000. Wilson Potter, 22 East 17th St., New York, archt. Noted Mar. 19.

Ind., Plainfield — Apr. 15, by Bd. School Comrs., 2 story, basement, brick, steel stone high school addition, incl. gymnasium, auditorium. $150,000. Parker & Faulstich, 501 Bd. Trade Bldg., Indianapolis, archt. Noted Apr. 2.

La., Baton Rouge—Apr. 27, by Bd. Supervs. Louisiana State University and Agricultural & Medical College, women's dormitory, on campus. Weiss, Dreyfus & Seiferth, Inc., Maison Blanche Bldg., New Orleans, and Wogan & Bernard, Old Reymond Bldg., New Orleans, archts. Building program for this year also includes home economics cottage, student center and fine arts buildings. Total est. $1,000,000. Noted Mar. 19.

Mass., Boston—Suffolk Law School, G. L. Archer, dean, 20 Derne St., taking bids reconstructing 4 story, basement, brick preparatory law school, plain found., Hancock and Myrtle Sts. $150,000 or more. R. T. Jackson, 44 School St., archt. Noted Mar. 12.

Mass., Charlestown (sta. Boston)—Apr. 16, by Cit. of Boston, Dpt. School Buildings, 3 story, basement, brick ,limestone, steel intermediate school, plain found., Walker and Eden Sts., Warren-Bunker Hill Dist., $640,000. J. M. Gray, 175 High St., Boston, archt. Noted Jan. 15.

Mass., Leominster—Apr. 14, by School Com., and M. A. Dyer Co., archts., 1 Beacon St., Boston, 2 story, basement, brick, stone school addition, plain found., Lancaster St. $150,000. R. D. Kimball Co., 6 Beacon St., Boston, engrs. Noted Apr. 2.

Minn., Mapleton—Apr. 21, by Bd. Educ., J. H. Starkey, clk., 3 story, basement, rein.-con., brick, stone school. $150,000. G. Pass & Son, and R. T. Rockey, Mankato, archts. Noted Oct. 30.

N. H., Rochester—City, L. McDuffee, mayor, City Hall, bids about Apr. 10, 2 story, basement, brick, stone, plain found., Maple St. $150,000. W. S. Holmes Co., Lansing, Mich., archt. Noted Mar. 26.

N. J., Westwood—Fanning & Shaw, archts., 49 Ward St., Paterson, taking bids general contract 2 story, basement, 110 x 125 ft., brick, steel, rein.-con., plain found., Irvington St. and Washington Ave., for St. Andrews Parochial School, J. P. Lehman, pastor, Washington Ave. $150,000. Noted Mar. 12.

N. Y., New York—Apr. 21, by Bd. Higher Educ., at office Secretary Hunter College, Park Ave .and 68th St., general contract gymnasium for Hunter College, Bedford Park Blvd., Goulden, Jerome and Navy Aves. Hhompson, Holmes & Converse, and C. B. Meyers, 101 Park Ave., archts.

O., Delaware—Apr. 10, by Bd. Educ., F. C. Bergen, clk., 3 story, basement, brick, steel, concrete high school. $350,000. T. D. McLaughlin & Associates, 610 Savings Bank Bldg., Lima, archts. Noted Oct. 9.

Pa., Lawrence Park—Bd. Educ., P. Gill, secy., bids about Apr. 15, 2 story, basement, 95 x 145 ft., brick, steel high school addition, incl. auditorium, gymnasium. $150,000. C. S. Kirby, 116 West 10th St., Erie, archt.

Pa., New Milford—Apr. 11, by F. A. Artley, sec. Consolidated School Dist., 2 story, basement, 10 room, rein.-con., brick addition, plain found., Church St. $150,000. L. M. Davis, 302 Rehrig Bldg., Scranton, archt.

Pa., Pittsburgh—Apr. 15, by Bd. Educ., H. W. Cramblet, secy., Administration Bldg., Prospect Elementary and Junior High School, 3 and 4 story, basement, 240 x 250 ft., brick, steel, Southern and Prospect Sts. $600,000. J. T. Steen & Sons, Vandergrift Bldg., archts. C. L. Woolridge, Fulton Bldg., consult. engr. Noted Mar. 17.

Wis., Manitowoc — Apr. 14, by Bd. Educ., Junior High School. $270,000. Van Ryn & DeGelleke, 114 Wisconsin Ave., Milwaukee, archts. Noted Feb. 5.

CONTRACTS AWARDED

Calif., Los Angeles—University of California, 405 Hilgard Ave., Westwood, 3 story, basement, 160 x 216 ft., rein.-con., stone dormitory, Hilgard Ave. and Manning St., Westwood, to H. M. Baruch Corp., 1015 Lincoln Bldg., $180,525. Noted Jan. 15.

Ill., East St. Louis—St. Patricks Catholic Parish, P. J. Byrne, pastor, 612 Illinois Ave., general contract 120 x 156 ft. school, 38 x 61 ft. rectory with 20 x 22 ft. garage, both 2 story, basement, rein.-con., brick, steel, concrete founds., to J. J. Keeley, Jr., 4114 State St.; heating, to Elliott & Barry Eng. Co., 4060 West Pine Blvd., St. Louis, Mo.; plumbing, to M. J. Kiekham Plumbing & Heating Co., Arcade Bldg., electric wiring, to McKane Electric Co., 333 North 5th St. Noted Mar. 26.

Ill., Evanston—Bd. Educ., general contract high school addition, to Ralph Sollitt & Co., 228 North La Salle St., Chicago, $163,350. Noted Nov. 14, 1929.

Ind., Indianapolis — School Comrs. general contract Grade School 56, 2 story, basement, brick, steel, to Capitol Eng. & Constr. Co., 254 North Capitol Ave. Est. $150,000. Noted Mar. 19.

Ky., Louisville—Bd. Educ., 8th and Chestnut Sts., general contract 2 story, part basement, 180 x 350 ft. irregular sized rein.-con., brick, tile stone, to R. Moore, Cecil Ave., $203,760; heating and ventilating, to Redmon Heating Co., 124 North 4th St., $39,872; electric wiring, to Thirlwell Electric Co., 106 North 4th St., $7,610. Grand total $251,242. Noted Mar. 12.

Me., Rumford—Town, L. S. Williams, supt. Schools, and Bunker & Savage, archts., 254 Water St., Augusta, altering and constructing 2 story, basement, brick, stone high school addition, incl. auditorium, gymnasium, plain found., to Louis Milo & Sons, 51 East Ave., Lewiston. Est. $150,000. Noted Jan. 8.

Md., Baltimore—Bd. Awards, 2 story, basement, brick school addition, to Lacchi Contg. Co., Munsey Bldg., $102,602. Noted Mar. 19.

Mass., Marlboro—City, W. Temple, chn. comm. 2 story, basement, brick, stone, plain found., to T. P. Hurley Constr. Co., 196 Main St. Est. $150,000. Noted Feb. 5.

Mich., Detroit—C. A. Gadd, mgr. Bd. Educ., 1354 Broadway Ave., 2 story, basement, brick, rein.-con., steel, plain found., Hildale Ave., to A. W. Kutsche Co., 2111 Woodward Ave. Est. $150,000.

N. J., Manasquan—Bd. Educ., general contract 3 story, basement, brick, steel high school, to J. A. Sarubbi Constr. Co., 415 20th St., West New York, $169,940; heating and ventilating, to Burns, Lane & Richardson, New Brunswick, $25,241; plumbing, to L. W. Casner, Avon, $11,998; electrical work, to Buhl & Caffery, 35 Hudson St., Newark, $11,767. Grand total $218,946. Noted Mar. 5.

N. J., Trenton—State Bd. Educ., State House, plumbing for 2 story, basement, 160 x 175 ft., brick, steel addition to Teachers State College, to D. McGrath Co., 185 Moore St., Hackensack, $23,176; heating, to W. E. Bittner, 2015 Hamilton Ave., $41,840; electrical work, to Badaracco Bros., 403 Washington St., Hoboken, $21,590. Grand total $86,606. Noted Mar. 26.

N. J., Union City — Holy Family Roman Catholic Church, J. N. Greff, pastor, 34th St., general contract 3 story, basement, 70 x 140 ft., brick, steel high school addition, 32nd and Central Ave., to State Builders, Inc., 24 Commerce St., Newark. Est. $150,000.

N. J., Wyckoff—Bd. Educ., School Bldg., general contract 1 story, basement, 70 x 160 ft., brick, steel, to Reliable Constr. & Eng. Co., 604 Anderson Ave., Grantwood, plumbing, to D. McGrath Co., 185 Moore St., Hackensack, heating A. Mowell & Co., 177 Gould Ave., Paterson; electrical work, to A. Neri, Inc., 928 Washington St., Hoboken; steel and iron work, to Selback & Meyer Co., 661 22nd St., West New York. Est. $150,000. Noted Mar. 5.

N. Y., Buffalo—Bd. Educ., Genessee Bldg., general contract altering and constructing addition to School 64, to Metzger Constr. Co., 676 Genesee St., $257,684; plumbing, to S. Wright, Inc., 392 Franklin St., $12,993; heating and ventilating to Batt Co., Inc., 955 Michigan Ave., $44,950; electrical work to Lackawanna Electric Co., 483 Ridge Rd., $16,116. Grand total $331,743. Noted Aug. 28.

N. Y., Cohoes—Bd. Educ., general contract superstructure 3 story, basement, 117 x 127 ft. brick, stone, school to C. P. Boland & Co., 161 Park Ave., New York, $97,170; heating, to J. E. Harbison, 213 Union St., Schenectady; plumbing to Scotland & Monroe, Cohoes, electrical work, to Smith Auto & Electric Supply Co., Cohoes.

N. Y., Sloan—Union Free School Dist. 9, general contract 3 story, 62 x 75 ft. school addition, to Widzinski Bros., 95 Walden St., Buffalo $169,198. Noted Mar. 26 Daily.

Pa., Pittsburgh—Bd. Educ., H. W. Cramblet, secy., Administration Bldg., electrical contract Prospect Elementary and Junior High School, 4 story, basement, 240 x 250 ft., brick, steel, Southern and Prospect Aves., to Hale Electric Co., 6202 Pennsylvania Ave., $29,600. J. T. Steen & Sons, Vandergrift Bldg., archts. Soon takes bids on general contract. Noted Mar. 12.

Pa., Pittsburgh — Pennsylvania College for Women, Woodland Rd., 1 story, basement, 39 x 124 ft., brick, stone library, 5th Ave. and Woodland Rd., to W. T. Grange Constr. Co., Keenan Bldg. Est. $250,000.

THEATRES

PROPOSED WORK

Calif., Glendale—Davis-Glendale Co. plans by A. F. Priest, 719 Fay Bldg., Los Angeles, 2 story, rein.-con., tile, incl. stores, Glendale Blvd. between Davis and Grover Sts. $150,000.

Calif., San Francisco — Ninth and Market Street Co., A. F. Rousseau, agt. 110 Sutter St., sketches by D. A. Stone, 337 17th St., 17 story theatre, hotel, office, on 275 x 375 ft. site, incl. 1,400 car garage, 9th and Market Sts. $10,000,000 or more.

Mass., Boston—Adams House Realty Corp., H. K. Noyes, pres., 857 Commonwealth Ave., will take general contract bids or let without competition about May, theatre, Washington St. $2,500,000. A. H. Rowditch, 44 Bromfield St., archt. Paramount Publix Corp., 1501 Bway., New York, Lessee. Noted Mar. 5.

Mass., Boston — Terminal Theatre Co., N. Thompson, 312 Congress St., rejected bids 1 story, brick, granite steel theatre, plain found., South Station, Dorchester Ave. To exceed $150,000. Hendrick & Hayward, 192 Boylston St., archts. Noted Mar. 19.

Que., Montreal—Confederation Amusement Co. Ltd., 149 St. Alexander St., 92 x 130 ft. theatre, St. Dennis St. $210,000.

BIDS ASKED

Calif., Pasedena—Bennett & Haskell, archts., 1st Trust Bldg., taking bids 2 story, rein.-con. theatre, for Colorado-Madison Syndicate, c/o architects. $150,000. Noted June 26.

CONTRACTS AWARDED

Calif., Los Angeles—Pilgrimage Play Assn., c/o W. L. Woollett, archt., 802 Architects Bldg., 1 story, 120 x 130 ft., rein.-con., amphitheatre, 1,470 ft. seating capacity incl. museum, retaining walls, Hilgard and Cahuenga Aves., to W. Simpson Constr. Co., 1007 Architects Bldg., $150,000.

Pa., Phila.—S. Shapiro, 1218 Chestnut St., 1 story, basement, balcony, 154 x 200 ft., rein.-con., brick, steel theatre, to W. M. C. Smello, Bankers Trust Bldg. Est. $500,000. Noted Nov. 14, 1929.

BANKS

PROPOSED WORK

O., Zanesville—First National Bank, soon lets contract 5 story, basement, 80 x 80 ft. brick, steel, concrete bank. $150,000. O. C. Darst, 150 East Broad St., Columbus, archt. Noted Mar. 26.

CONTRACTS AWARDED

Ariz., Phoenix—Valley Bank Building, Inc., Craig Bldg., 11 story, 135 x 150 ft., brick, steel, bank and office to L. E. Dixon, 609 South Grand Ave., Los Angeles. $800,000. Noted Jan. 1.

OFFICES

PROPOSED WORK

Calif., San Francisco—Anchor Chain Co., 11 Stuart St., plans by H. H. Winner, 580 Market St., 22 story, Class A office building, Market and Stuart Sts. $2,000,000.

N. Y., Stapleton—New York & Richmond Gas Co., 691 Bay St., St. George, sketches office, $150,000. **Maturity indefinite.** Private plans.

Ont., Toronto—Canadian Property Holdings, Ltd., c/o N. A. Armstrong Co. Ltd., archts., 7 King St. E., 20 story, basement, concrete or steel frame, marble, stone office, 8-10 King St. W. $1,600,000.

Ont., Toronto—Imperial Bank of Canada, 32 Wellington St. E., plans by Sproatt & Rolph, 1162 Bay St., structural steel, stone, brick, head office building, concrete founds., King and Bay Sts. $2,000,000 up.

STORES

PROPOSED WORK

N. Y., Jamaica—H. Levy, 113-18 Jamaica Ave., plans by B. Braunstein, 163-18 Jamaica Ave., 4 story store, office, Jamaica Ave. and 153rd St. $150,000.

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Stores (Continued)

N. J., Union City—S. Slatkin, 17 Oak St., Weehawken, 3 story basement, brick, steel store, office, 169-73 Summit Ave., $150,000. **Maturity in June or later.** F. W. Woolworth, Franklin Trust Bldg., Phila., lessee. A. Hakes, archt., in charge. Noted Mar. 12.

BIDS ASKED

N. J., Asbury Park—C. B. Cook, archt., Asbury Park Trust Bldg., taking bids 2 story, basement, brick, steel, incl. offices, for J. Ackerman, 404 Asbury Park. $150,000. Noted Apr. 2.

N. J., Long Branch—See "Contracts Awarded."

N. J., Maplewood—W. J. Fitzsimmons, archt., 626 Central Ave., East Orange, bids about Apr. 15, 2 story, basement, brick, steel store, apartment, 91 Baker St., for E. J. Baker, c/o architect. $150,000. Noted Apr. 2.

CONTRACTS AWARDED

N. J., Long Branch—Peter Realty Corp., 2 story, basement, brick, steel stores, apartment, Ocean Ave., separate contracts. $150,000. H. B. Seymour, 512 McClellan Ave., archt.

N. J., Newark—W. E. Lehman, archt., 972 Broad St., general contract 2 story, basement, brick, steel store, apartment, to Fatzler Co., 11 Hill St., for Bratter & Pollak, 972 Broad St. Est. $150,000. Noted Feb. 26.

LOFTS

BIDS ASKED

Mass., Worcester—Owner, c/o G. A. Johnson, archt., 16 Norwich St., sketches loft. $175,000.

PUBLIC

PROPOSED WORK

Ind., South Bend—PUBLIC—Bd. Comrs. St. Josephs Co. sketches 6 story public building. $300,000. Architect not selected.

Mass., Boston—POLICE STATION—City, Dpt. P. Buildings, sketches by J. M. Gray and J. P. Hefferman, 175 High St., 2 story, basement, brick, Richmond and North Sts. $350,000.

Mass., Gloucester—FIRE STATION—City H. J. Marchant, fire chief, sketches by Phillips & Holloran, 191 Main St., fire station, Magnolia Sect. $150,000.

Mass., Jamaica Plain (sta. Boston)—LIBRARY—City of Boston, Library Dpt., trustees, Copley Sq., sketches by Maginnis & Walsh, Statler Bldg., Boston, 1 story, brick, stone branch library, Boylston Dist. $150,000.

Mass., Milton (br. Boston)—ADMINISTRATION—Town, K. D. Johnson, chn. Bd. Selectmen, 2 story, basement, brick, stone, plain found., Walnut St. $150,000. Architect not selected.

Mass., Natick—COURT HOUSE—Town, M. T. Hall, moderator, court house, incl. police station. $150,000. Architect not selected. Noted Jan. 22.

Mass., Walpole—MEMORIAL—Town, H. W. Caldwell, chn. building com., plans by Putnam & Cox., 114 State St., Boston, memorial building. $125,000-$150,000.

N. J., Bradley Beach—MUNICIPAL—Bd. City Council, 701 Main St., altering and constructing 2 story, basement, 60 x 100 ft., brick, steel, addition, LaReine Ave. and Main St. $150,000. **Maturity about June.** K. & M. Towner, Kinmouth Bldg., Asbury Park, archt. Noted Mar. 5.

N. J., Elizabeth—CITY HALL, etc.—Bd. City Comrs., City Hall, 8 story, basement, brick, steel, rein.-con., city hall and municipal building, $150,000. **Maturity probably soon.** Architect not selected.

N. J., Emerson—BORO HALL—Bd. Boro Council, F. Pascarella, mayor, 2 story, basement, brick, steel. $150,000. **Maturity about June.** Architect not selected. Noted Mar. 12.

N. J., Matawan—BORO HALL—Bd. Boro Council, 2 story, basement, brick, steel, Main St. $150,000. **Maturity probably soon.** Architect not selected.

N. J., Red Bank—LIBRARY—Bd. Boro Council revised sketches by E. A. Arend, Kinmouth Bldg., Asbury Park, 1 story, basement, brick, steel. $150,000. Noted Feb. 12.

N. J., Rutherford—MUNICIPAL—Bd. Boro Council, Boro Hall, 2 story, basement, brick, steel. $150,000. Architect not selected. Project in abeyance. Noted Mar. 26.

N. J., South Belmar—BORO HALL, etc.—Bd. Boro Council, Boro Hall, 2 story, basement, brick, steel boro hall, jail and police headquarters. $150,000. **Maturity probably soon.**

N. J., Weehawken—LIBRARY—Township Com., Municipal Bldg., sketches by Hensel & Weir, 254 Summit Ave., Union City, 2 story, basement, brick, steel school, Park and Hauxhurst Sts. $150,000. Noted Dec. 11.

N. J., Westwood — LIBRARY — Bd. Trustees Free Public Library 2 story, basement, brick, steel. $150,000. **Maturity probably soon.** Architect not selected.

Okla., Shawnee—COURT HOUSE—Pottawatomie Co., sketches rein.-con., brick, plain found. $500,000. Architect not selected.

Pa., Reading—COURT HOUSE—Bd. Comrs. Berks Co., 4th and Court Sts., plans by W. H. Dechant & Son, 632 Washington St., court house. $1,750,000. Noted June 12.

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BIDS ASKED

Ark., Texarkana—JAIL and JAILERS HOME—May 5, by Miller Co., J. J. Jewell, judge, 5 story, rein.-con., brick, steel, Broad and Laurel Sts. $150,000. Witt, Seibert & Halsey, Texarkana Natl. Bank Bldg., archts. Noted Dec. 4.

Calif., San Francisco — WAR MEMORIAL OPERA HOUSE, etc. — Apr. 28, by trustees San Francisco War Memorial, granite work, architectural terra cotta, Indiana limestone and exterior cast stone work, for American Legion Memorial Building and Opera House, Civic Center, for City and San Francisco Co. Total $5,000,000. Noted Apr. 2.

Conn., Manchester—LIBRARY, etc.—Apr. 14, by Town and Y. M. C. A. and Hutchins & French, archts., 11 Beacon St., Boston, Mass., 2 story, basement, brick library and Y. M. C. A. units, plain founds. To exceed $150,000.

Mo., St. Louis—POLICE STATION, etc.—Apr. 17, by Bd. Police Comrs., L. O. Hocker, pres., 2 story basement, 112 x 134 ft., rein.-con., stone police station, garage, Kansas Ave. and Colorado St. $150,000. Klipsetin & Rathmann, 316 North 8th St., archts. Noted Feb. 26.

N. J., Elizabeth—COURT HOUSE—Bd. Freeholders Union Co., Court House, bids about May 15, 15 story, basement, brick, steel, plain found., North Broad and Rahway Sts. $500,000. Oakley & Sons, 1259 Clinton Pl., archts. P. West, 13 Central Ave., Newark, engr. Noted Feb. 12.

N. J., Fort Lee—ADMINISTRATION—Port of New York Authority, 80-90 8th Ave., New York, bids about May 15, 2 story, basement, brick, steel, Bridge Plaza, between Hudson Terrace and Hoyt Ave. $150,000. Private plans.

N. J., Jersey City—HALL OF RECORDS—Bd. Freeholders Hudson Co., Court House, bids about May 1, 16 story, basement, brick, steel, adjoining court house. $2,000,000. J. T. Rowland, 30 Veterans Sq., archt. Noted Mar. 26.

N. J., Woodbine—DORMITORY—Apr. 14, by Dpt. Institutions & Agencies, State Office Bldg., Trenton, general contract Dormitory 7, 2 story, basement, brick, steel, at State Colony for Feeble Minded Females. $150,000. Div. Architecture & Constr., State Office Bldg., Trenton, archts.

CONTRACTS AWARDED

N. J., Hackensack—ADMINISTRATION—Bergen Co., Court House, excavating, grading, tunnels, waterproofing, piling, 1st floor found. for administration building, to F. W. Bogert, Huyler St., $133,000. Noted Mar. 5.

N. Y., White Plains—OFFICE—Bd. Supervs. Westchester Co., Court House, general contract office, to W. L. Crow Constr. Co., 101 Park Ave., New York, est. $1,370,000; heating and ventilating, to Hauxwell & Smith, Portchester, $225,000; plumbing, to G. E. Gibson, 441 Lexington Ave., New York, $108,625. Grand total $1,703,625. Noted Jan. 15.

Okla., Stillwell—COURT HOUSE—Adair Co., general contract court house, to J. H. Reddick, Ft. Smith, Ark., $59,552. Noted Jan. 22. Heating and plumbing, to Jones Supply Co., Siloam Springs, Ark., $6,877; jail equipment, to Southern Prison Co., San Antonio, Tex., $5,700.

Ont., Toronto—HORSE STABLE—W. J. Stewart, City Hall, mayor, masonry and carpentry contract for 1 and 2 story stable at Exhibition Park, for Canadian Natl. Exhibition, Lumsden Bldg., to Christman Burke, Ltd., Canada Permanent Bldg., $431,650; structural steel, to Dominion Bridge Co. Ltd., 1139 Shaw St., $153,765; plumbing, drains, heating and ventilating to John Ritchie Ltd., 102 Adelaide St. E., $80,000; stalls and stable fittings, to Beatty Bros., Fergus, $101,159. Grand total $768,574. Electrical work from Canadian Comstock Co. Ltd., 80 King St. W., $57,617. Noted Sept. 18.

UNCLASSIFIED

PROPOSED WORK

Calif., Pomona — NEWSPAPER PLANT — Pomona Progress-Bulletin plans by L. Rogers, 2412 West 7th St., Los Angeles, 6 story, basement, rein.-con. Class A. 3rd and Thomas Sts. $250,000.

Mass., Quincy—RAILROAD STATION—New York, New Haven & Hartford R.R., E. E. Oviatt, ch. engr., New Haven, Conn., sketches railroad station. To exceed $150,000. Private plans.

Mass., Springfield—MUSEUM—City, Library Assn., N. D. Bill, pres., sketches by A. M. Githens & E. L. Tilton, 420 Lexington Ave., New York, gray museum unit, State and Chestnut Sts. $350,000.

Mass., Worcester—MEMORIAL—City, bids early in May, general contract municipal memorial auditorium, Lincoln Sq. $2,000,000. Hirons & Mellor, 40 East 49th St., New York, and L. W. Briggs Co., 314 Main St., archts. H. G. Balcom, 10 East 47th St., New York, engr. Noted Mar. 5.

Mo., Kansas City—EXCHANGE—Southwestern Bell Telephone Co., 11th and Pine Sts., St. Louis, soon lets contract superstructure 2 story, basement, 104 x 140 ft., rein.-con., 63rd and Holmes Sts. I. R. Timlin, 1916 Telephone Bldg., St. Louis, archt. W. J. Knight, Wainwright Bldg., St. Louis, engrs.

Mass., Lynn—EXCHANGE—Apr. 16, by New England Telephone & Telegraph Co., and Densmore, LeClear & Robbins, archts., Park Sq. Bldg., Boston, 3 story, basement, brick, stone, steel, concrete, concrete found., City Hall Sq., Essex and Washington Sts. $150,000 or more. Noted Mar. 12.

N. J., Jersey City—HOME—Hebrew Home for Aged, M. Hurwitz, chn., 161 Summit Ave., bid about May 1, general contract 3 story, basement, metal lath, brick, steel Jewish home for aged, Fowler and Van Nostrand Aves. C. Shilowitz, 26 Journal Sq., archt. Noted Mar. 12.

CONTRACTS AWARDED

Ala., Birmingham — MASONIC — Kamran Grotto Masons, Lincoln Life Bldg., 8 story, basement, red brick, limestone, marble, Five Points, to Mackle Building Co., 615 South 27th St., $325,000. Excavation just started.

Mo., St. Louis—EXCHANGE—Southwestern Bell Telephone Co., 11th and Pine Sts., 2 story, basement, 100 x 130 ft., brick, rein.-con., to Humes-Deal Co., 777 Arcade Bldg., $850,000. heating and plumbing, to T. J. Sheehan Co., 2233 Olive St., electrical work, to Gamp Electric Co., 517 Spruce St. Noted Nov. 20.

O., Cincinnati—PASSENGER STATION—Cincinnati Union Terminal Co., Temple Bar Bldg., 1 to 6 story, 350 x 720 ft., rein.-con. stone, incl. 125 ft. high dome, west of Lincoln Park, to Jas. Stewart Co., 230 Park Ave., New York, $5,899,000. Noted Mar. 19.

Pa., Phila.—STATION—Pennsylvania R.R. Co., Broad St. Sta., T. J. Skillman, ch. engr., clearing site and excavation for founds. for new station incl. 250,000 cu.ft. earth excav., 60,000 lin.ft. steel pipe, 15,000 cu.yd. caissons, 60 ft. below surface on bedrock, 30th and Market Sts., to Keystone State Corp., Philadelphia Bank Bldg. $1,500,000.

Industrial Buildings

FACTORIES AND MILLS

PROPOSED WORK

Ia., Sioux City—BAKERY—Campbell-Taggart Associated Bakeries 30th and Troost Sts., Kansas City, Mo., sketches brick, concrete. $200,000.

Mass., Boston—PRINTING SHOP—City, Dpt. P. Buildings, sketches by J. M. Gray and J. P. Hefferman, 175 High St., 3 story, basement, brick. Richmond St. $300,000. Noted Jan. 15.

Mass., Northbridge — FACTORY — Kupfer Bros. Co., Riverdale, brick addition. $50,000. Private plans.

N. J., Garfield—LAUNDRY PLANT—Owner, c/o A. L. Viglianti, archt., 40 Passaic St., 1 story, basement, brick, steel laundry plant. $40,000.

N. J., Newark—FACTORY, etc.—Owner, c/o W. E. Lehman, archt., 972 Broad St., sketches 2 story, basement, 98 x 130 ft., brick, rein.-con. factory, office, Frelinghuysen Ave. and Noble St. $40,000.

N. Y., New York—GAS PLANT—Consolidated Gas Co., Irving Pl., central distributing gas plant, East 174th St. **Maturity indefinite.**

O., Cleveland—FACTORY—W. M. Hardie Co., W. M. Hardie, pres., 2260 East 69th St., plans by J. E. A. Moore, 1900 Euclid Bldg., 6 story, basement, 60 x 115 ft., brick, steel, East 19th and Payne Sts. $200,000. Noted Dec. 5, 1929.

Tex., Beaumont—PACKING PLANT—Jacob Decker & Son, Beaumont and Mason City, Ia., packing plant. $50,000.

Tex., Brownsville—CANNING PLANT—Reynolds Bros., Sturgeon Bay, Wis., 2 story, rein.-con., brick, concrete found., Adams Tract, near here. $100,000.

Tex., Gonzales—KAOLIN FACTORY—Max B. Miller & Co., Inc., kaolin factory to refine crude oil. Private plans.

Va., Portsmouth — FACTORY — Proctor & Gamble Co., Gwynne Bldg., Cincinnati, O., altering Portsmouth Cotton Oil Refining Plant with possibility of large addition. To exceed $40,000. **Maturity indefinite.**

Ont., Rodney — FACTORY — Canada Wood Products Co., Rodney (owned by Thomas Bros., St. Thomas), rebuilding basket and box factory, recently destroyed by fire. $100,000 loss.

Que., St. Lambert—CREOSOTING PLANT—J. J. Seguin Co. soon lets contract two 1 story buildings 1 to house creosoting cylinder and other to contain machinery. $150,000 incl. equipment.

BIDS ASKED

Mass., Everett—PLANT—Merrimac Chemical Co. taking bids Glauber Building, 2 story, 60 x 150 ft., brick, steel, plain found., Chemical Lane. $65,000. Private plans.

N. J., East Rutherford—REPAIR SHOP—L. B. Huesman and J. Dynes, archts., 15 Orient Way, Rutherford, taking bids general contracts 2 story, basement, 50x120 ft., brick, steel repair shop, garage, office, Morton St., for Craig Coal Co., 10 Park Ave. $40,000.

Tex., Longview — ICE PLANT — See "Contracts Awarded."

Tex., Mission — PACKING PLANT — Amer. Fruit Growers, c/o C. C. McElwain, Mission, taking bids 80 x 170 ft., fruit curing and packing plant, corrugated iron, timber, concrete. $125,000. Private plans.

CONTRACTS AWARDED

Calif., West Anaheim (Anaheim P. O.)—STORAGE and PRE-COOLING PLANT—Anaheim Co-Operative Orange Assn., 1 story, part basement, 5 x 155 ft., rein.-con., hollow tile, Lincoln Ave., to H. A. Hamm, 2145 Sacramento St., $65,000.

Factories and Mills (Continued)

Conn., Bridgeport—DAIRY—Mitchell Dairy Co., 745 North Ave., 2 story, 78 x 80 ft., brick, steel, concrete addition, Garland St., to Pardy Constr. Co., 1481 Seaview Ave. Est. $50,000.

Ind., Bloomfield—TOOL FACTORY—Harrah Mfg. Co., 1 story 50 x 115 ft., rein.-con., brick, steel, Spring and Jefferson Sts., to L. O. Cooper, Bloomfield. Est. $42,000.

Ind., Indianapolis—BAKING PLANT—South Side Baking Co., 915 South Meridian St., rein.-con., brick, steel. $40,000. Owner builds. Private plans.

Ind., Indianapolis—FACTORY—G. T. Mayer Co., 36 South Meridian St., general contract brick, steel addition, Liberty and Market Sts., to Van Landingham, Lemcke Bldg. Est. $40,000.

Ind., Shirley—PLANT—Kraft-Phoenix Cheese Co., rein.-con., brick, milk receiving plant, equipment. $40,000. Owner builds. E. Anderson, supt. constr.

Mass., Lawrence—MANUFACTURING—Essem Packing Co., 101 Beacon St., 2 story, concrete block, steel, Beacon St., to L. C. Cyr, 45 Melrose St. Est. $40,000.

N. J., Jersey City—BACTERIOLOGICAL LIBRARY—Hudson Co., Court House, general contract 1 story, basement, brick, steel, Foyle Pl., to E. M. Johnson, 706 Bergen Ave.; plumbing, Murphy Plumbing Co., Inc., 597 Grove St.; electrical work, to T. J. Regan, 674 Summit Ave.; laboratory equipment, to Laboratory Furniture Co., 67 6th St., Long Island City, N. Y. Est. $40,000.

N. J., Ridgefield Park—PAPER PLANT—Continental Paper Co., River Rd., general contract two story, basement paper plant building, to Claus Ahrens & Co., Inc., 72 Uhlandt St., East Rutherford. Est. $40,000.

N. Y., Syracuse—GAS HOLDER—Syracuse Lighting Co., 421 South Warren St., 6,000 M cu.ft. Stacey-Klonne gas holder, to Stacey Bros. Gas Constr. Co., 5575 Carthage Pike, Elmwood, Cincinnati, O.

O., Ashland—PRINTING PLANT—Ashland Times-Gazette Co., 1 story, basement, 40 x 100 ft., brick, steel, concrete, to C. V. Hootman, Ashland. Est. $40,000. Noted Mar. 5.

Pa., Pittsburgh—FACTORY—D. J. Rex Box Co., Boyd and Locust Sts., rebuilding factory, to W. J. Payne, 87 Beltzhoover Ave. Est. $40,000. Noted Apr. 2.

Pa., Pittsburgh—FACTORY — Mayer Body Corp., c/o W. G. Mayer, pres., 6459 Frankstown Ave., 1 story, basement, 30 x 100 ft. and 2 story basement, 50 x 100 ft., brick, concrete, steel additions, to Edward Crump, Jr., 4031 Bigelow Blvd. Est. $40,000. Noted Mar. 12.

Pa., Ridgway—TANNING PLANT—Elk Tanning Co., Ridgway, Pa., and 2 Park Ave., New York, one 50 x 160 ft. and one 74 x 100 ft. additions, to Hyde-Murphy Constr. Co., Ridgway. Est. exceeds $40,000.

Tex., Beaumont—BAKERY—Fehr Baking Co., 1104 Leeland St., Houston and 1919 North Comal St., San Antonio, 1 story, 150 x 150 ft., brick, rein.-con. tile, stucco, plain found., to C. J. Patterson Corp., 4050 Penn St., Kansas City, Mo., $45,000. Noted Feb. 19.

Tex., Longview — ICE PLANT — Morgan Utilities Co., Inc., 1 story, 75 x 100 ft., rein.-con., brick, steel, plain found., 100 ton capacity, day labor. $150,000. Private plans. Construction started.

GARAGES

PROPOSED WORK

Ark., Hot Springs—See "Residential."

Ind., South Bend—Standard Oil Co., sketches rein.-con., brick, steel super-service station, McKinley and Ironwood Dr. $40,000. Private plans.

Ill., East St. Louis—Goodrich Silvertown, Inc., c/o R. E. Kenner, zone mgr., 527 North 14th St., St. Louis, Mo., 2 story, concrete, brick, terra cotta super-service station, on 50 x 140 ft. site, 9th St. and St. Louis Ave. $40,000.

N. Y., Jamaica—Cord Meyer Development Co., 108-16 Queens Blvd., Forest Hills, sketches by I. Englehard, c/o owner, 100 x 252 ft. service garage, 68th Rd. and East Yellowstone St. $100,000.

N. Y., New York—Barrow Street Corp., S. O'Keefe, pres., 347 Madison Ave., plans by N. Rotholz, 155 East 42nd St., service garage, 174 Christopher St. $275,000.

N. Y., New York—S. Cincelli, 2393 Arthur Ave., sketches by M. W. Del Gaudio, 545 5th Ave., 1 story, 90 x 119 ft. service garage, Hoffman and 184th Sts. $40,000.

N. Y., New York—J. Vanek, 46 Lee Ave., Yonkers, sketches by E. R. Kane, 1044 East Tremont Ave., service garage, Corlear Ave. and West 238th St. $40,000.

N. Y., New York—Webster Auto Wrecking Co., B. Cohen, pres., sketches by W. I. Hohauser, 17 West 44th St., 40 x 180 ft. garage, shop, Carter Ave. and 174th St. $40,000.

BIDS ASKED

Calif., Los Angeles—See "Contracts Awarded."

Mass., Dorchester (sta. Boston)—See "Contracts Awarded."

N. H., Milford — Souhegan Motor Co., c/o A. W. Osberg, archt., 795 Elm St., Manchester, soon takes bids altering and constructing 2 story, 50 x 105 ft., brick, steel public service garage, concrete found. $40,000. Noted Mar. 26.

CONTRACTS AWARDED

Calif., Los Angeles—Los Angeles Gas & Electric Co., 810 South Flower St., rein.-con. substation, West 36th St., day labor. $60,000. Private plans.

Ill., East St. Louis—Goodrich Silvertown, Inc., R. E. Kenner, zone mgr., 527 North 14th St., St. Louis, Mo., 1 story, part basement, concrete, brick super-service station, 9th St. and St. Louis Ave., to Austin Co., Arcade Bldg., St. Louis, Mo. Est. $40,000.

Mass., Dorchester (sta. Boston)—J. A. Singarella, Park Sq. Bldg., Boston, 1 story, 50 x 105 ft., brick, rein.-con. garage, office, separate contracts. $45,000. Private plans. Noted Apr. 2.

Mass., Malden (br. Boston)—Eastern Auto Parts Co., 182 Eastern Ave., altering and constructing 1 story, 75 x 90 ft., brick, steel service station and store addition, plain found., Eastern Ave., to S. Glazier, 115 Nichols St., Everett. Est. $40,000.

Mo., St. Louis—A. E. Black, 801 Louderman Bldg., 1 and 2 story, 102 x 142 ft., concrete, brock, steel garage, warehouse, 1024-26 North 20th St., to James Black Masonry & Contr. Co., 801 Louderman Bldg. Beatrice Creamery Co., 2119 Morgan St., lessee.

Ont., Toronto—Blythwood Motors, Ltd., Blythwood and Yonge Sts., general contract 1 and 2 story, part basement, brick, steel garage and service station, concrete found., to J. H. McKnight Constr. Co., 88 St. David St. Est. $150,000.

SHOPS AND FOUNDRIES

PROPOSED WORK

Mass., Worcester—SHOP—City, P. Wks. Dpt. plans by R. G. Gorrani, 175 Green St., and soon takes bids 3 story, 50 x 175 ft., brick, steel, rein.-con. shop for Public Works, East Worcester. $150,000.

N. Y., Long Island City—SHOP—Dpt. Water Supply, Gas & Electricity, Municipal Bldg., New York, plans by D. Campbell, c/o owner, 2 story, 52x150 ft. shop and office, Dryer and Packard Sts. To exceed $50,000.

BIDS ASKED

Conn., Cheshire — SHOP — See "Contracts Awarded."

Mass., Longmeadow—SHOP—Apr. 10, by Town, F. E. Smith, clk., 1 story, 50 x 125 ft., and 40 x 40 ft., brick, cast stone municipal work shop, Ponside St. $40,000. R. W. Mowry, 25 Harrison Ave., Springfield, archt.

CONTRACTS AWARDED

Conn., Cheshire — SHOP — See "Contracts Reformatory, brick, timber shop to manufacture markers, inmate labor. $40,000. Private plans. Noted Mar. 5.

N. Y., Napanoch—SHOP, etc.—Dpt. Correction, State Office Bldg., Albany, general contract shop and storehouse at Institution for Defective Delinquents, to de Hammel Constr. Co., Plymouth Bldg., Cleveland, O., $201,400; heating, to Barr & Creelman Co., 74 Exchange St., Rochester, $7,579; sanitary work to Bareham & McFarland, Inc., 366 Main St., E., Rochester, $17,552; electrical work, to W. W. Gottberg, Rochester, $7,671. Grand total $234,202. Noted Jan. 22.

POWER PLANTS

PROPOSED WORK

Ind., Auburn—School Comrs. taking bids rein.-con., brick, steel power plant improvements, water supply service, hot water heater. $50,000. Pohlmeyer & Pohlmeyer, 260 Central Bldg., Ft. Wayne, archts.

Ind., Ft. Wayne—Bd. Directors Indiana School for Feeble Minded, Black Hawk Farm, Hicksville Rd., new power plant, tunnels, steam distribution system. $195,000. R. W. Noland, 408 Cal-Wayne Bldg., engrs.

Mass., Boston—Edison Electric Illuminating Co., 39 Boylston St., soon takes bids superstructure power plant, Kneeland and Utica Sts. Total $750,000. Noted Feb. 19.

Mass., Holyoke—Holyoke Water Power Co., R. E. Barrett, pres., plans by R. A. Smith, 1 Canal St., brick, steel, concrete hydro-electric plant, $500,000. Noted Feb. 19.

Okla., Fairfax—City, O. T. Corwin, clk., new election soon $120,000, power plant. V. V. Long & Co., 1300 Colcord Bldg., Oklahoma City, engrs. Noted Mar. 19.

S. D., Vermillion—City, c/o M. Viers, mayor, 1 story, electric light plant. $52,000.

Man., Winnipeg—Winnipeg Heating Co. Ltd., Rockwood and Dorchester Sts., plant extension. $1,000,000.

BIDS ASKED

Ind., Auburn—U. G. Souder soon takes bids brick, steel, stone power plant addition for hospital. $40,000. L. Bradley, 221 West Wayne St., Ft. Wayne, archt.

N. J., Convent Station—Fanning & Shaw, archts., 49 Ward St., Paterson, taking bids 1 and 2 story, basement, 68 x 95 ft., brick, steel, rein.-con. power house, for St. Elizabeth's College Sisters of Charity. $40,000.

N. Y., New York—Dpt. Hospitals, Municipal Bldg., bids about May 15, general contract boiler house addition, stack, at Welfare Island. K. M. Murchison & W. H. Gompert, 101 Park Ave., archts. Noted Mar. 19.

CONTRACTS AWARDED

Mass., Boston—Boston Elevated Ry., 31 St. James St., turbo-generator for electric plant, Lincoln Power Station, to Westinghouse Mfg. & Electric Co., 150 Bway., New York. Est. $500,000.

Mass., Boston—Edison Electric Illuminating Co., 39 Boylston St., excavation for steam heating plant, incl. excavation for underground piping, Kneeland and Utica Sts., to A. G. Tomasello & Son, Inc., 250 Stuart St.

O., Berea—City, T. R. Barnum, pres. Bd. P. Affairs, furnishing, erecting one 1,000 kw. generator for municipal light plant, to Westinghouse Electric & Mfg. Co., 2209 Ashland St., Cleveland. $30,350. Noted Oct. 9.

WAREHOUSES

PROPOSED WORK

Mass., Jamaica Plain (sta. Boston)—Walter Curley & Son, 418 Amory St., reconstructing warehouse, Amory St. $50,000 or more. Architect not selected.

N. Y., New York—Lincoln Warehouse Corp., 1187 3rd Ave., F. E. Webb, pres., will award contract after June 1, warehouse, bank, office, 701 East 69th St. $500,000. G. S. Kingsley, 103 East 125th St., archt. Noted Jan. 22.

N. Y., New York—Randik Realty Co., I. Koch, 206 Lexington Ave., plans by B. H. Whinston, 6 East 46th St., altering and constructing storage, store addition, 649 Lexington Ave. $150,000.

Pa., McKeesport—Standard Oil Company of Pennsylvania, Peoples Gas Bldg., Pittsburgh, and Ledger Bldg., Phila., bulk oil plant, tank farm. $100,000. **Maturity soon.** Private plans.

Tex., Beaumont—City, c/o Dock & Wharf Co., soon takes bids new cotton warehouse. $50,000.

Wis., Milwaukee—N. P. Rockes, archt., 808 North 3rd St., soon lets contract 2 story, basement, 110 x 175 ft., brick, concrete warehouse, St. Paul, for Desbroc Co., Milwaukee.

Ont., Toronto—Canadian Natl. Rys., New Union Sta., and Canadian Pacific Ry. Co., Windsor St. Sta., Montreal, Que., brick, concrete, structural steel, joint fruit and vegetable terminal building, foot Bathhurst St. $2,000,000. Not decided as to who will prepare plans.

BIDS ASKED

N. Y., New York—See "Contracts Awarded."

N. Y., New York—New York Central R.R. Co., F. B. Freeman, ch. engr., 466 Lexington Ave., bids about Apr. 10, 10 story, 100 x 103 ft. cold storage and refrigeration warehouse, 430 West 14th St. $700,000. E. A. Dougherty, 466 Lexington Ave., designing engr. J. M. Doorly, engr. for New York Terminal Dist.

N. Y., New York—Star Co., 220 South St., will award contract about May 1, 3 story warehouse, factory, 419 Water St. and 95 Market St. $95,000. Lockwood, Greene & Co., 100 East 42nd St., engrs. Noted Feb. 26.

CONTRACTS AWARDED

Calif., San Francisco—California State Bd. Harbor Comm., Ferry Bldg., general contract cold storage terminal addition at Pier 46, to C. D. DeVelbiss, 369 Pine St., $9,570; insulation contract, to Cork Insulation Co., 354 Pine St., $29,749; machinery and brine circulation system, to Carbondale Mchy. Co., South Bway., Los Angeles, $28,079. Grand total $87,398. Noted Mar. 19.

Mass., Boston—Old Colony Trust Co., 17 Court St., reconstructing 5 story, brick, storehouse, South St., recently destroyed by fire, to Sawyer Constr. Co., Park Sq. Bldg. Est. $40,000.

N. Y., New York—One Hundred Thirty-seven East 57th Street Corp., B. S. Weil, pres., 295 Madison Ave., 6 story, storage store, to J. H. Taylor Constr. Co., 31 Union Sq. West. $150,000. Noted Mar. 19.

N. Y., New York—Port of New York Authority, 80-90 8th Ave., excavation and founds. for freight terminal, 8th and 9th Aves., 15th and 16th Sts., to Godwin Constr. Co., 370 Lexington Ave. $855,000. Noted Jan. 8.

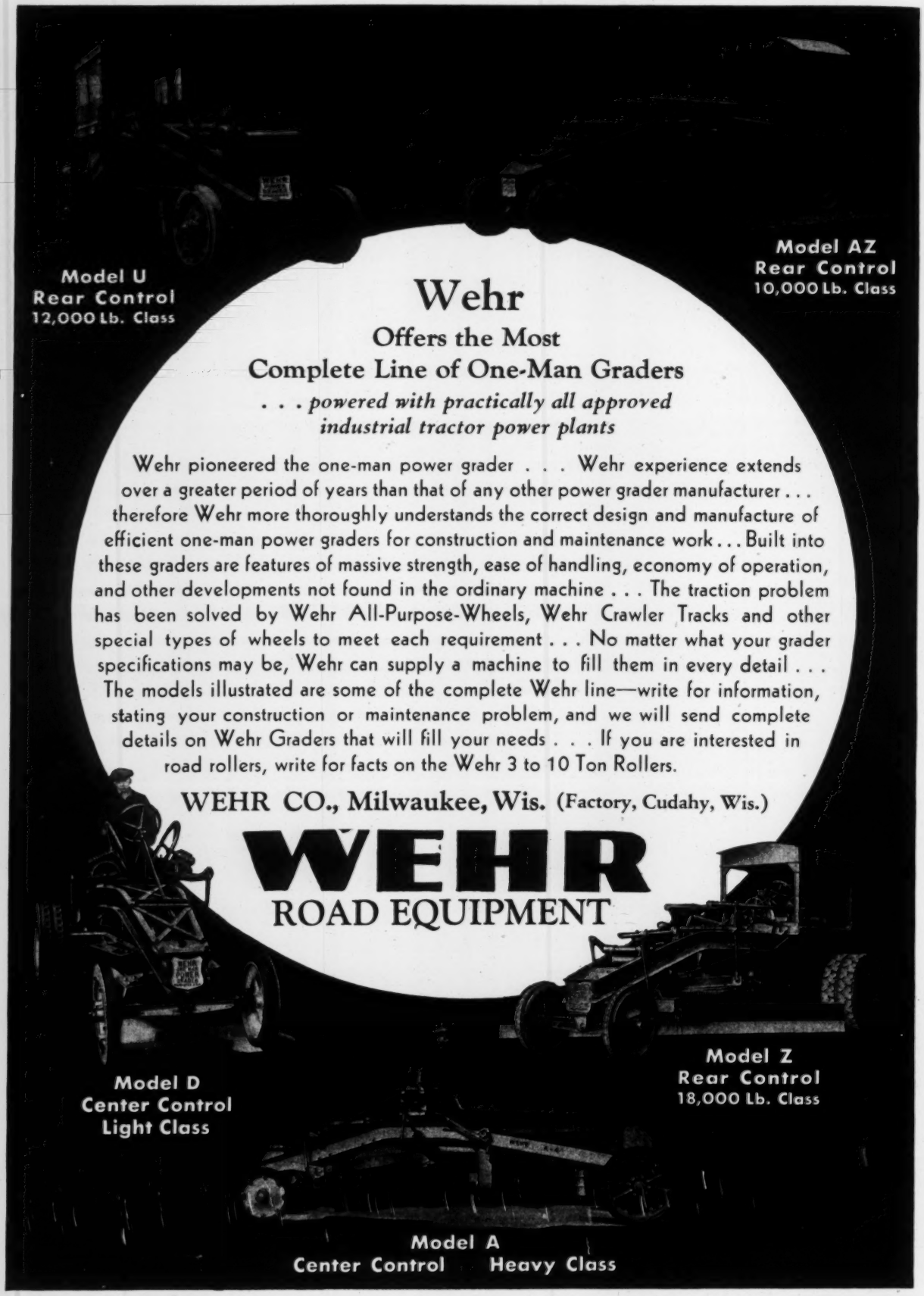
N. Y., New York—Spear & Co., 22 West 34th St., general contract 10 story, 100 x 145 ft. warehouse, to Industrial Eng. Co., 50 Church St., est. $450,000; excavation, founds. to Underpinning & Foundation Co., 342 Madison Ave., steel and steel erecting to Levering Garrigues Co., 552 West 23rd St. Noted Mar. 12. Contractor taking bids on sub-contracts.

Ont., Toronto—Bd. Educ., 155 College St., construction, masonry, etc., 3 story, basement, 114 x 132 ft. storage building, McCaul St., to John V. Gray Constr. Co., Northern Ontario Bldg., $165,960; plumbing and heating, to Bennett & Wright, 72 Queen St. E., $34,000; electric wiring, to Moss Electric Co., 156 St. Clements Ave. Est. $200,000.

Que., Montreal—Canada Malting Co., 5200 St. Ambroise St., 72 x 144 ft., storage building, St. Ambroise St., to E. C. M. Cape Ltd., 620 Cathcart St., $165,000.

See proposal advertising on page 176

Constr. News page 159



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